NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

THE EFFECTS OF PARENTAL LEAVE POLICY CHANGES WITHIN THE UNIFORMED MILITARY SERVICES

by

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March 2019

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REPORT DOCUMENTATION PAGE			*Form Approved OMB No. 0704-0188*
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.			
1. AGENCY USE ONLY ***(Leave blank)***	**2. REPORT DATE** March 2019	**3. REPORT TYPE AND DATES COVERED** Master's thesis	
4. TITLE AND SUBTITLE THE EFFECTS OF PARENTAL LEAVE POLICY CHANGES WITHIN THE UNIFORMED MILITARY SERVICES			**5. FUNDING NUMBERS**
6. AUTHOR(S) Laura Laurita and Matthew Molloy			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release. Distribution is unlimited.			**12b. DISTRIBUTION CODE** A

13. ABSTRACT (maximum 200 words)

The United States has no federal mandates for paid family leave (PFL), an unusual standing among the world's developed countries. Recent Department of Defense (DoD) policy initiatives have expanded paid maternity and family leave to offer more support to new mothers and other caregivers. The DoD's increase in maternity leave is a unique policy change for a large and diverse organization. Family leave policies are established as an incentive for attracting and retaining talent. Military leadership emphasized the need to retain the talent and value of female service members as motivation for recent paid maternity leave expansion. Few papers have examined how large-scale programs such as PFL affect parental behavior across demographics in the United States. With a better understanding of the effects from PFL policy changes, the military can employ policy aimed at retaining service members. Our paper examines recent changes to DoD parental leave policy for active duty service members. In 2015, the Department of the Navy tripled paid maternity leave from 6 to 18 weeks. In 2016, the DoD standardized paid maternity leave, reducing Navy and Marine Corps policy from 18 to 12 weeks of maternity leave and expanding Army and Air Force policy from 6 to 12 weeks of maternity leave. Our study uses difference-in-difference and regression discontinuity design methods to examine the impact of these policy changes on retention, birth and pregnancy outcomes, and parental leave taken.

14. SUBJECT TERMS personnel, manpower policy, retention, separation, manpower policy issues, special studies, quality of life, QOL, maternity, paternity, parental leave, female studies, birth, pregnancy, Department of Defense, military, Navy, Marine Corps, Army, Air Force			**15. NUMBER OF PAGES** 101
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UU

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89) Prescribed by ANSI Std. 239-18

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THE EFFECTS OF PARENTAL LEAVE POLICY CHANGES WITHIN THE UNIFORMED MILITARY SERVICES

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

The United States has no federal mandates for paid family leave (PFL), an unusual standing among the world's developed countries. Recent Department of Defense (DoD) policy initiatives have expanded paid maternity and family leave to offer more support to new mothers and other caregivers. The DoD's increase in maternity leave is a unique policy change for a large and diverse organization. Family leave policies are established as an incentive for attracting and retaining talent. Military leadership emphasized the need to retain the talent and value of female service members as motivation for recent paid maternity leave expansion. Few papers have examined how large-scale programs such as PFL affect parental behavior across demographics in the United States. With a better understanding of the effects from PFL policy changes, the military can employ policy aimed at retaining service members. Our paper examines recent changes to DoD parental leave policy for active duty service members. In 2015, the Department of the Navy tripled paid maternity leave from 6 to 18 weeks. In 2016, the DoD standardized paid maternity leave, reducing Navy and Marine Corps policy from 18 to 12 weeks of maternity leave and expanding Army and Air Force policy from 6 to 12 weeks of maternity leave. Our study uses difference-in-difference and regression discontinuity design methods to examine the impact of these policy changes on retention, birth and pregnancy outcomes, and parental leave taken.

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LIST OF ACRONYMS AND ABBREVIATIONS

DACOWITS	Defense Advisory Committee on Women in the Service
DMDC	Defense Manpower Data Center
DiD	difference in difference
DoD	Department of Defense
DoN	Department of Navy
EAS	end of active service
FD	first difference
FMLA	Family Medical Leave Act
FY	fiscal year
MOS	military occupational specialty
NDAA	National Defense Authorization Act
OECD	Organisation for Economic Co-operation and Development
PFL	paid family leave
PTAD	permissive temporary assigned duty
RD	regression discontinuity
RDD	regression discontinuity design
SECDEF	Secretary of Defense
SECNAV	Secretary of the Navy
TFDW	Total Force Data Warehouse
TIS	time in service
USA	United States Army
USAF	United States Air Force
USMC	United States Marine Corps
USN	United States Navy

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EXECUTIVE SUMMARY

Background

In recent years, military leadership has emphasized the need to retain talented women in the Armed Services through progressive policies that support them. Since 2005, the Department of Defense (DoD) has implemented deployment deferments for new mothers, health-hazard regulations from job-related duties, paternity leave expansion, family separation limitations, breastfeeding and lactations support policy, and fitness assessment and weight deferments postpartum, among others. In addition, the National Defense Authorization Act (NDAA) of 2015 highlighted the need for better healthcare specific to women and maternity care. The Defense Advisory Committee on Women in the Services (DACOWITS) report in 2015 recommended more standardized, updated, and regular reviews of policy related to pregnancy and parenthood. With finding based on focus group data, the committee also noted inadequate maternity leave, separation and deployment-related challenges for dual and single service members with children, and inadequate time for postpartum recovery and breastfeeding (DACOWITS, 2015).

In July of 2015, the Department of the Navy (DoN) expanded its maternity leave policy. The Secretary of the Navy authorized an unprecedented 18 weeks of maternity leave to women serving in the Navy and Marine Corps, retroactive to January 1, 2015. Not more than six months later, the Secretary of Defense standardized maternity leave to a 12-week period, effective March 2016. From 2016 to 2018, the scope of these polices expanded to cover unmarried, adoptive, and same-sex couples; and include paternity leave benefits. The non-discriminatory nature of recently expanded policy extended parental leave benefits from exclusively maternity leave rights to parental leave rights. The effects of that expansion contribute to the military's theme of retaining talent and value, but more broadly for all service members of any gender or caregiver title.

It is also important to recognize that other issues may be contributing to policy initiatives for expanded parental leave rights and the effects of those policies on service member retention. In the past two years, additional military manpower requirements amid low unemployment nationwide have strained military recruiting and retention.

Furthermore, the military's implementation of a new blended retirement system reduces incentives for potential careerists. Also, operational tempo among the services has changed since late 2016 due to the presidency change and end to the military drawdown.

Our study analyzes the effects of maternity leave policies over the last two years of implementation, relative to pre-implementation years, across various demographics and subgroups within the Army, Air Force, Navy and Marine Corps active-duty population. We recognize the military's recent parental leave policy is more inclusive of all parental roles and genders; however, our study does not observe the impacts of those recent changes mainly due to lack of observation time. The goal of our research is to estimate whether the maternity leave policy changes were impactful on retention, leave-taking, pregnancy and birth outcomes across the Army, Air Force, Navy and Marine Corps.

Area of Research

Published research on parental leave policy pertains primarily to developed countries in Europe, Australia and Canada (Olivetti & Petrongolo, 2017). Although the United States is a developed country, it has lagged in establishing federal parental leave policies, and currently has no federal mandates for paid parental leave. As of early 2019, several states within the United States have implemented paid parental leave rights, often referred to as paid family leave, or PFL, and the current presidential administration has proposed a federally funded paid family leave program.

Aside from the gradual trend of state governments to implement more favorable paid family leave policies, many major companies have established paid parental leave incentives and policies on their own terms. They offer employees anywhere from 13 weeks to 26 weeks of paid parental leave, and some extend that to both parents (Connley, 2017). Adding incentives like paid family leave may promote retention of employees with families or those who want to start families. Similarly, the DoN and DoD added incentives to service members by establishing extended and flexible paid family leave programs. Unlike state or business family leave programs, military family leave entitlements provide 100 percent pay and benefits, job security, and parental leave cannot be denied but only deferred (e.g.,

a service member is deployed). Our study observed the effects of military policy that increased the maternity leave program with full pay and benefits already provided.

Scope and Methodology

We use data from the Defense Manpower Data Center (DMDC) and the Marine Corps' Total Force Distribution Warehouse (TFDW). The two datasets include active-duty service member observations, by monthly snapshot, from January 2013 through December 2017, with the TFDW data extended through August 2018. We employ several demographic control variables and control for the monthly military drawdown through early 2017 and the monthly national unemployment rate for the civilian labor force. In order to measure pregnancy, birth, and leave-taking outcomes, we observe monthly snapshots of a service member's duty limitation code, leave type and dates, and dependent child information like date of birth and age. Because TFDW is our only data source that records leave-specific data, we can only estimate leave-taking outcomes for the Marine Corps.

We use three quantitative methods of analysis in this study: first difference, difference-in-difference and regression discontinuity design. The first difference (FD), difference-in-difference (DiD) and regression discontinuity design (RDD) methods estimate the 6-week, 12-week, and 18-week policy effects on service member leave-taking, retention, pregnancy and birth outcomes. The difference-in-difference (DiD) method compares different outcomes between approximately two years before policy implementation relative to the periods after policy implementation across services; different services act as treatment and control groups depending on the policy period. We then interact those policy periods with observations of added babies for a difference and difference approach. A strength in this method is that control and treatment group demographics and baselines should have few differences, if any. Also, although other female-friendly and mother-friendly policies were implemented during our observation period, none would be considered as economically significant as six additional weeks of fully paid maternity leave benefits.

We use regression discontinuity design to identify estimated effects for the various maternity leave policy changes from 6 to 18 weeks, 18 to 12 weeks, and 6 to 12 weeks. Because these policies were either unexpected or could not be predicted, it is highly unlikely that female service members self-selected into any treatment group. Therefore, the discontinuous effects should be sharp or apparent around the policy implementation date (not including observations in the retroactive policy period) for leave-taking estimates. To estimate 6-month and 12-month postpartum retention effects, we employ RD design around the retroactive policy date to include service members who retroactively received additional maternity leave.

There are some special considerations in our analytical design. Usually, life decisions like starting a family or leaving military service are circumstantial or determined over time. We try to address the time delay in our study by measuring birth and pregnancy outcomes that occur within the ten months after the maternity policies are put into place. Also, we further divided the three maternity leave policy periods to isolate service member expectations of leave relative to the amount of leave they received. By doing so, we attempt to estimate the effects of maternity leave policy changes on service members' decisions to have children or take leave based on their expectation of the maternity leave and not just dumb luck of having children immediately after the policy change. Another important aspect of our analysis is controlling for military drawdown effects and national unemployment rates. For the time period we observed, all military services—barring the Navy and Air Force—experienced continuous drawdown through fiscal year 2016 followed by a general increase for all services through fiscal year 2018. Not accounting for the periods of drawdown could potentially overstate the estimated effects of maternity leave policy increase on retention, since some of the increase in female retention may be due to the drawdown slowing down after the 2017 presidential inauguration. We include a monthly end-strength control in all of our models to avoid overstating the retention estimates. Additionally, national unemployment rates also show decline during our observation period, which crosses a U.S. presidential election. Controlling for the unemployment rates reduces the variation in labor demands external to the military, but which may influence service member retention. Another consideration is that service

members do not have the "two weeks' notice" option to end their employment like most of the civilian labor force. Typically, all services require between 6-to 12-months of lead time for voluntary separations (e.g., officer resignation) or reenlistments. Therefore, the voluntary separations process could have an impact on retention estimates related to maternity leave policy effects. We attempt to account for the lead time required for retention decisions by adding a control for time left until a service member's end of active service date.

Results and Conclusions

Following the maternity leave policy changes, leave taking for mothers and fathers increased in quantity and shifted in composition during the year after a dependent childbirth. After the 18-week maternity policy announcement, fathers were 5-percentage points more likely to use any leave in the paternity period, while mothers were 3.3-percentage points and 3.4-percentage points more likely to use parental leave and any leave, respectively. Males were also 6.4-percentage points and 4.1-percentage points more likely to be on parental leave and any leave following the 12-week maternity policy announcement.

Not only were they more likely to take leave, the amounts of parental leave used by mothers and fathers also increased in both the 12- and 18-week maternity leave policy periods relative to the 6-week maternity leave policy period. For fathers, these changes occurred without a subsequent increase in paternity leave policy during the period of observation. The increases in leave-taking may also indicate that maternity leave policy implementations led to a shift in workplace attitudes towards parental leave for mothers *and fathers*, within the Marine Corps. Although paternity leave amounts had not yet changed during our data observation period, the Marine Corps' culture surrounding leave-taking may have improved for fathers.

The composition of leave-taking also changed for mothers and fathers. The increased quantities of parental leave used by new mothers exceeded the increased amounts of all leave used by new mothers during the 18-week policy period. This outcome suggests that mothers used parental leave in the 18-week policy period in place of annual leave used

by mothers in the 6-week maternity leave policy period. More specifically, the additional maternity leave allowed mothers to reduce annual leave used previously to supplement time they wanted or needed following childbirth. During the 12- and 18-week policy periods, fathers increased their quantities of all leave used more than parental leave used for the same period. This is not surprising since paternity leave allowed (10 days) remained constant. However, fathers took more annual leave following the maternity leave policy changes, potentially to supplement the lack of additional paternity leave. Altogether, these results suggest that as military mothers shifted away from using annual leave in favor of expanded maternity leave, military fathers also increased their leave-taking behavior but using mostly annual leave.

We use caution when interpreting the parental leave results due to the potential that better maternity and paternity leave-recording coincided with the maternity leave policy changes. However, annual and combat leave appear to be consistently recorded, so even if the change in paternity leave taken was a result of more paternity leave recorded, there was still an uptick in leave taking for fathers. We also claim no causal effects of the changes in maternity leave policies for service members on birth outcomes, pregnancy, or retention during the data observation period. The limited Marine observations for birth and pregnancy outcomes indicated no significant effects as a result of the policy changes. Across all services, retention outcomes relating to maternity leave policy changes and having children were mixed and not statistically robust. Also, when accounting for the military drawdown leading up to the U.S. presidential election and the changes in the national unemployment rate across our years of observation, the magnitude and statistical significance of retention outcomes were diminished.

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ACKNOWLEDGMENTS

We would like to acknowledge the assistance provided by our advisors, Dr. Jennifer Heissel and Dr. Marigee Bacolod. We also would like to acknowledge the Manpower Systems Analysis faculty for giving us the tools necessary to complete our thesis. Lastly, we would like to acknowledge our spouses, Anthony Laurita and Stephanie Molloy, for supporting us during the thesis process.

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I. MILITARY POLICY

A. INTRODUCTION

In the last decade, the United States Military has progressively institutionalized policies aimed at supporting parental rights of service members and promoting retention among female service members by providing them lengthened and flexible paid parental leave. Since 2005, the Department of Defense (DoD) and its military services have implemented standardized or service-specific policies covering a broad range of parental aspects such as deployment deferments for new mothers, health-hazard regulations regarding job-related duties, parental leave expansion, family separation limitations, breastfeeding and lactations support policy, and fitness assessment and weight deferments postpartum, among others. A conclusive list of these policies by each service is detailed in the Defense Advisory Committee on Women in the Service (DACOWITS) *2015 Report* (DACOWITS, 2015). These changes coincide with the greater social changes surrounding pregnancy and parenthood in the American workforce. In Chapter II, we discuss a modest evolution of parental policies from global, national, and social perspectives. At the core of many of these changes over the past two decades is the growing empirical research that demonstrates a multitude of medical benefits—especially psychological and physiological—from prenatal and postpartum care, extended mother-infant bonding, extended breastfeeding, and paternal bonding and participation. The DoD's pregnancy and parenthood policy progression coincides with the increase in empirical research, but it also aligns with the significant social transformation in favor of pregnancy and postpartum care over the last two decades in America.

B. STATISTICS/DEMOGRAPHICS OF WOMEN IN THE MILITARY

1. When Women First Start to Serve

Women first served in an official capacity in the military when the Army established a permanent Nurses Corps under the Army Reorganization Act of 1901. Under this legislation, nurses served with the Regular Army for renewable three-year terms, although they were not commissioned as officers. In 1948, Congress passed the Women's

Armed Services Integration Act, which allowed women to serve in a permanent, active or reserve capacity and accumulate veteran's benefits. Beginning in the 1970s, the military allowed women to serve in a more integrated and forward presence, including admission to service academies and integrated basic training. By the turn of the century, women could fly in combat missions, serve on combat ships and command combat units.

2. Recent Demographics

Since 2000, the proportion of women serving in the four military services (Army, Navy, Air Force, Marine Corps), has increased from 14.6 percent to 16.5 percent as of March 2018 and as show in Figure 1 (DMDC, 2018). While the increase in percent of women serving is not economically significant, the quantity and scope of military policies that have been implemented since 2000 to recruit and retain women in the services are significant. Additionally, the services vary in population from as large as 476,000 Soldiers in the Army to as small as 185,000 Marines in the Marine Corps. Gender breakdowns also differ across services. The Air Force is near 20 percent female, while the Marine Corps is only 8.5 percent female (DMDC, 2018). The differences in service populations are set by Congress and achieved by individual services through recruiting, retention, and retirement of service members. Congress sets the individual service populations but not how they population should look demographically (gender, race, etc.). The likely reasons for the differences in gender breakdowns are driven by various service-specific factors like culture, physical fitness standards, work-life balance, occupational specialties, quality of life, deployment tempo, monetary incentives, and duty station locations, among others.

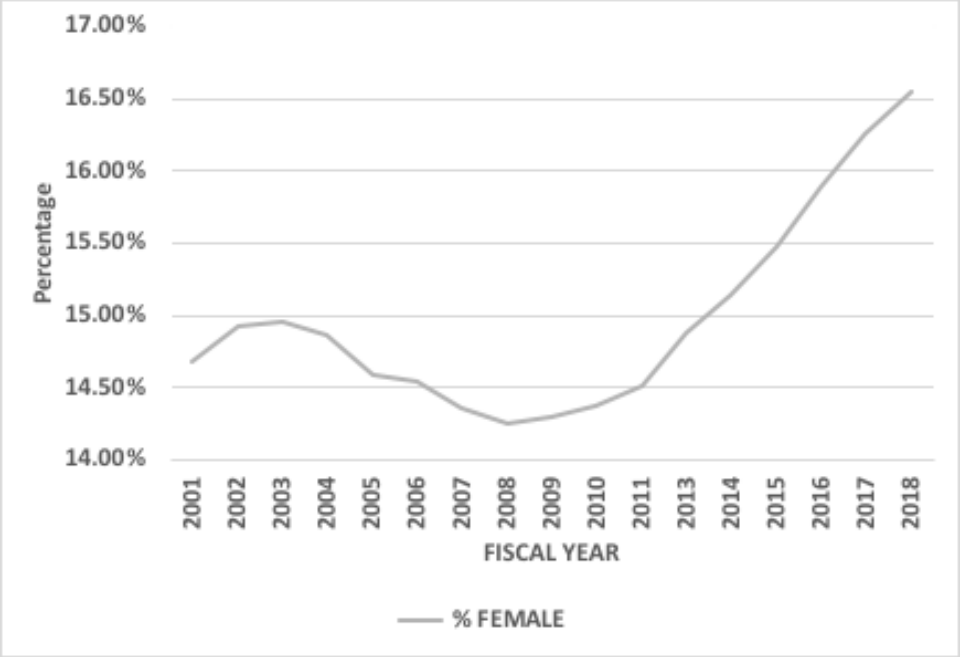

Figure 1. DoD Female Population Density (FY01-FY18).
Source: DMDC (2019).

3. Present Demographics Comparable to Civilian Workforce

According to the U.S. Bureau of Labor Statistics, a *2011 Current Population Survey* shows a decrease in the percent of women over the age of 16 that are employed based on the age of their children. According to the survey, 70.6 percent of women with children ages 6 to 18 years old are employed compared to 55.7 percent of women with children younger than 6 years and 51.5 percent of women with children younger than 3 years. This lower employment is likely a result of women caring for children that are not yet school age and who lack the economic feasibility to pay for out-of-home childcare. The *Current Population Survey* does not include military personnel in their labor force statistics; however, the trends of women with children may be comparable, or at least an indicator, to potential behavior of women in the military services or female spouses of those in the service. One aim of our study is to compare female active-duty service member retention as it relates to pregnancy and childbirth, and then explore how the findings compare to female labor-force trends.

C. CURRENT MILITARY POLICY ON PREGNANCY AND PARENTHOOD

In their 2015 report, DACOWITS outlined a mostly inclusive list of military policies, by service, related to pregnancy and parenthood since 2004 (DACOWITS, 2015). These policies include topics that support lactation and breastfeeding, require health hazard restrictions for pregnant women, implement deployment, physical fitness, and weight standard deferments, and minimize forced family separation. Specific guidelines for these policies vary for each service, but the Department of Defense imposes minimum guidelines on maternity leave, deployment deferment, and postpartum weight loss. Also, individual service chiefs have the flexibility to increase these guidelines above the minimum DoD mandates and nearly all services exceed the DoD minimum standards on policy related to pregnancy and parenthood.

Since 2015, the Department of Defense increased paid parental leave for both female and male service members, which is arguably one of the most impactful policies in support of service members having children. In an official message to service members on July 2, 2015, the Secretary of the Navy (SECNAV) established 18 weeks of paid maternity. In that message, the SECNAV emphasized a need to promote retention among female service members by ensuring added health and psychological benefits of extended recovery time and infant bonding before female service members return to demanding military duties (SECNAV, 2015). The 18 weeks of maternity leave includes 6 weeks of consecutive convalescent leave and then 12 remaining weeks that could be taken non-consecutively within the first year from a child's date of birth. This policy only applied to the Navy and Marine Corps and applied retroactively to mothers who had given birth on or after January 1, 2015. On January 28, 2016, the Secretary of Defense (SECDEF) standardized all maternity leave to a 12-week period of consecutive paid maternity leave for all services, thereby reducing the Navy and Marine Corps policies by 6 weeks but increasing the Army and Air Force policies by 6 weeks. Similar to the SECNAV's purpose for expanded maternity leave, the SECDEF described the intent of the policy as a method for female service members to better balance two important commitments: service to country and motherhood (SECDEF, 2016). Figures 2 and 3 illustrate the applicable maternity leave policy based on dependent-child birthday and/or service member pregnancy.

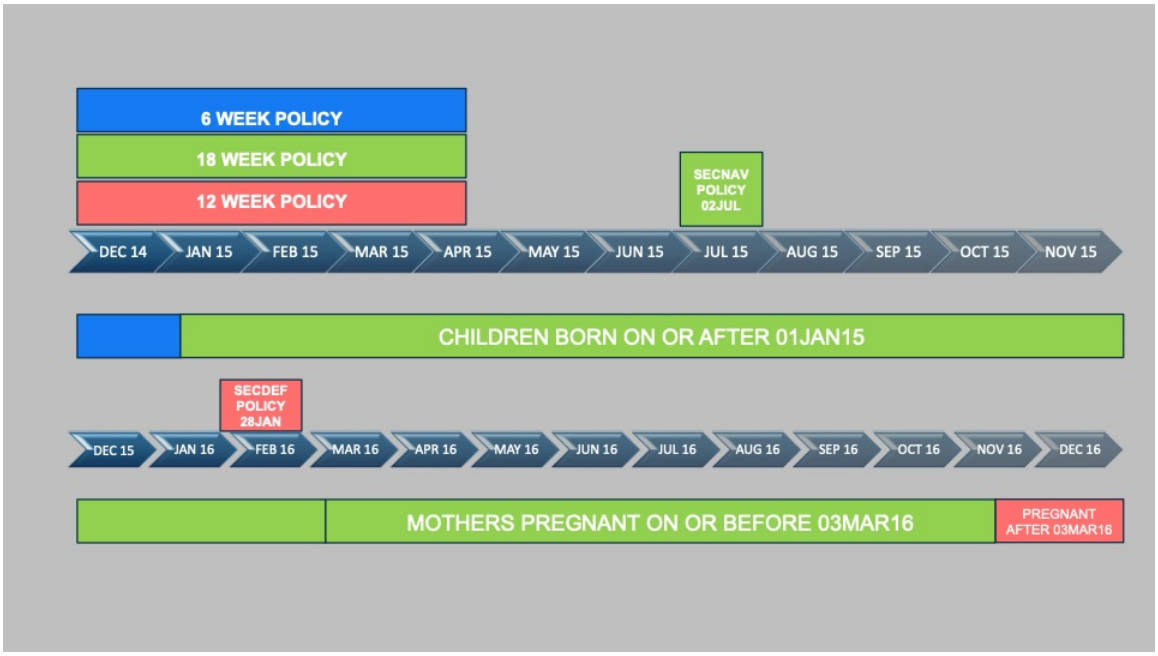

Figure 2. Policy Overview (USN/USMC)

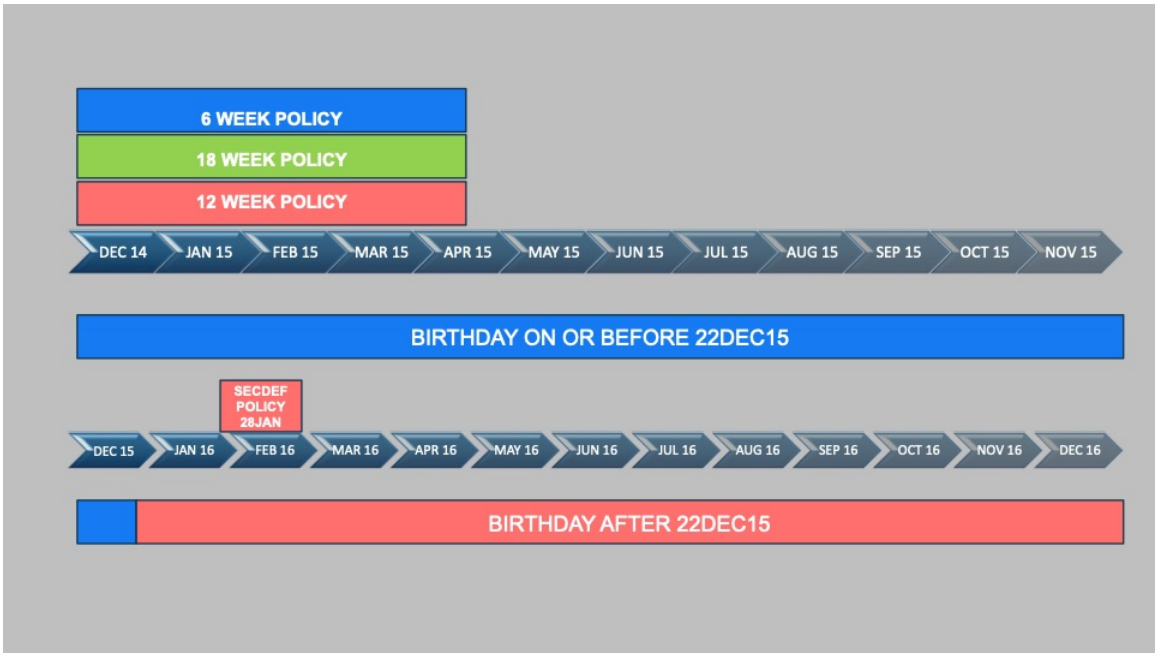

Figure 3. Policy Overview (USA/USAF)

With the recent flexibility authorized by the National Defense Authorization Act (NDAA) of 2017, the DoD further expanded the scope of its military parental leave program in 2018 to include benefits for additional caregivers, unmarried, same-sex, and adoptive parents. Primary caregivers are allowed to take 6 weeks of parental leave while secondary caregivers are allowed to take up to 3 weeks of parental leave. The primary and secondary caregivers must be declared before the birth or adoption of the child. The NDAA did not change the 6 weeks of maternity convalescent leave, which only a birth mother is eligible for. This policy was effective immediately and applied retroactively to December 23, 2016. The Navy and Marine Corps, in response to the 2017 NDAA, expanded secondary caregiver leave to 2 weeks. The Air Force and Army elected to allow the full 3 weeks for secondary caregivers under the new NDAA. This newest change to the military parental leave program allows dual service family members some added flexibility with minimal cost impact to the DoD.

Military policy changes supporting pregnancy and parenthood have shown dramatic changes in more recent years, but that is not reflective of federal government policy in general. Aside from the military being a federal organization, the policies affecting uniformed service members have not been extended to civilian counterparts working in the DoD. In addition, there is currently no federal mandate for paid family leave, beyond what the Family and Medical Leave Act (FMLA) prescribes. While state governments and businesses have more recently and aggressively expanded their paid family leave policies, there has not been a sweeping change across state governments or the federal government. Our next chapter discusses the dichotomous nature of parental leave internationally and within the United States.

D. BROAD SERVICE STUDY

There have been few studies (aside from Balser [2018]) that capture the effects of the paid parental leave changes within the United States on a large-scale business organization. In early 2018, a preliminary study on enlisted, female, active duty Airmen measured the effects of the maternity leave policy changes within the Air Force. Using regression discontinuity design, the study estimated positive and significant effects on

leave-taking following the policy change from 6 to 12 weeks—nearly 100 percent, with an average of 80.3 days of maternity leave taken (Balser, 2018). Also, his study estimated effects on the retention of married women and pregnant women after policy implementation were positive and significant; between 3.1 percent and 7.7 percent for all married women and 16 percent for first-time pregnant women. Though robust, Balser's study was limited to observing the retention of enlisted Airmen with 2 to 6 years of service at the time of policy implementation. This study also used time from pregnancy (6 month and 12 month) as markers for retention, whereas our study will use one year or 6 months from childbirth to measure retention. Our study aims to demonstrate the effects of parental leave policies on service members' pregnancy, birth outcomes, leave taking and retention amid a growing trend of policy that support service members in pregnancy and parenthood.

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II. LITERATURE REVIEW

A. GLOBAL PERSPECTIVE

Male and female workers in the United States do not have Paid Family Leave (PFL) guaranteed by the federal government. As part of the OECD (Organisation for Economic Co-operation and Development), the United States is the only country out of 36 without federally guaranteed PFL. According to Olivetti & Petrongolo (2017), all other OECD countries offer at least paid maternity leave; however, all but Italy and Canada also offer paid paternity leave, and median maternity leave for OECD countries falls between 14 and 22 weeks. Olivetti & Petrongolo further purported that United States policy supporting PFL has trailed other developed countries, whose PFL policies shifted progressively during the 20th century. The major expansion of PFL for Navy and Marine Corps female service members in 2015, and then its standardization across all services for females in 2016, demonstrated a significant policy and cultural shift for the U.S. government not seen since passing the 1993 Family and Medical Leave Act (FMLA). For the purpose of our study, we define PFL to include maternity leave, paternity leave and parental leave. Recent military policy has gender-neutralized parental leave terminology; however, our study precedes those changes and will not include gender-neutral terminology (e.g., primary and secondary caregiver leave).

Economic reasons for implementing aggressive PFL policies are to improve female employment, gender pay gaps and fertility (Olivetti & Petrongolo, 2017). Our study does not address gender pay gaps since our data observed U.S. service members who were paid the same salary regardless of gender. The Navy's primary goal for adding 12 weeks of maternity leave was to increase retention of women by ensuring their flexibility to become mothers and recover from childbirth and to promote extended time for infant bonding. Our analysis of the military services' recent policy changes to broaden and standardize PFL for women may provide insight to the economic dilemma of how to improve female retention, gender pay gaps aside.

In European labor markets, parental leave had been an aim for decades. In 1919, the International Labour Organization argued that 12 weeks of maternity leave, job protection and parental income support should be the norm (Olivetti & Petrongolo, 2017). In 1974, Sweden was the first country to introduce explicit parental leave rights. Mothers and fathers were offered 6 months of shared parental leave. In 1996, EU member nations granted a minimum of 3 months of parental leave for both mothers and fathers, and was offered in addition to maternity and paternity leave (Olivetti & Petrongolo, 2017). It is difficult to compare European parental leave benefits to the service members in our study due to the percent of salary that is paid to European workers. Maternity leave and paternity leave wage replacement average only 52 percent and 11 percent for OECD countries (Olivetti & Petrongolo, 2017).

B. AMERICAN PERSPECTIVE

Research in PFL shows benefits such as improved employee morale, increased likelihood to return to work after giving birth, decreased costs to employers due to improved employee retention and increased family incomes (Gault, Hartmann, Hegewisch, Milli, & Reichlin, 2014). Female service members in our data are afforded 6, 12, or 18 weeks of maternity leave based on when their pregnancy or birth occurred in conjunction with the maternity leave policy changes. Male service members in our data are afforded 10 days of paternity leave, although recent military policy has expanded paternity leave to 14 or 21 days based on their branch of service. All service members are afforded full job protection and their salary is paid in full. In comparison, states with PFL policies in the U.S. and most other developed countries in the world do not offer full wage replacement for maternity, paternity, or family leave benefits (Heyman, Earle, & McNeill, 2013; Rossin-Slater, Ruhm, & Waldfogel, 2011).

The amount of maternity leave offered to women has effects on their retention outcomes in the workplace. Berger and Waldfogel (2004) found that American women who were offered maternity leave were 40 percent more likely to return to work after childbirth than women who were not offered maternity leave. In addition, American women with access to maternity leave were 69 percent more likely to return to work 12

weeks after childbirth than their counterparts who did not have access to maternity leave (Berger & Waldfogel, 2004). This 12-week waypoint is important to our study since all U.S. military services standardized 12 weeks of maternity leave in 2016. It is important to differentiate that mothers in our study do not have the flexibility to immediately resign from service after childbirth like their civilian counterparts. On average, officers in our study are required to submit their resignation 9 to 12 months in advance of the date they request to resign. However, officers or enlisted members may request an administrative separation due to hardship related to pregnancy or childcare. Although these options to leave the service voluntarily are available following pregnancy and childbirth, they are typically longer administrative processes. The only way mothers in our study may extend their time away from work is by being placed on additional convalescent leave by their healthcare provider or by requesting to take annual leave following completion of their maternity leave. Active duty mothers earn 30 days of annual leave and can request to use annual leave in addition to maternity leave.

Among state governments within the United States, California first offered PFL, which included six weeks of partially paid leave for birth children, foster or adoptive children and other reasons like caring for an ill family member (Rossin-Slater et al., 2011). Rossin-Slater et al. used a difference-in-difference approach to examine the effects on mother's leave-taking after the California PFL policy change relative to mother's leave-taking before the policy implementation. In particular, they estimated that non-college educated, unmarried, and nonwhite mothers had the largest and most significant increase in leave-taking. This is not economically surprising, since other research has found that replacing partially unpaid leave with a paid leave program yields the largest leave-taking effects among disadvantaged women (Rossin-Slater et al., 2011). The service members in our data cover a wide range of demographics, education, and income. However, our policy change differs from these studies in that it changed from 6-weeks of fully paid maternity leave to an additional 6 to 12 weeks of fully paid maternity leave. Leave-taking is also different in our study, as service members must take leave over the weekends as well. For example, 6 weeks of leave in the civilian sector is 30 working days (Monday-Friday), while 6 weeks of leave in the military is 42 days (Monday-Sunday). Therefore, we anticipate

increased maternity leave-taking effects for the military across various demographics, education, and income to be relatively similar.

C. PATERNITY LEAVE

Bartel, Rossin-Slater, Ruhm, Stearns, & Waldfogel (2018) is one of the few studies that analyzes the effects of parental leave policy changes on men. They found an increase in leave taken for mothers and then argue that an added benefit of paternity leave is that fathers will become more involved in childcare during maternity leave. The study also indicates that a correlation may exist between PFL and long-term parental involvement with childcare, including the benefit of the long-term parental effects on role models and gender norms. Bartel et al. (2018) also argue that take up rates for parental leave are lower for men than women due to gender norms and gender roles in society. According to their results, women were seven times more likely to be on leave with a child under 1-year old as compared to men and there was a growing trend in the uptake rates for men using CA-PFL. The results further stated that the percent of CA-PFL claims filed by men rose from 19.6 percent to 30 percent of all CA-PFL claims from 2005 to 2013. Although men saw a 46 percent increase in the likelihood of being on paternity leave under CA-PFL, the economic increase in the amount of paternity leave used was only 2.4 days for fathers (Bartel et al.). Our study will analyze service member take-up rates of paid paternity leave in addition to how much paid annual leave male service members take following their 10 days of allotted paternity leave. Although current policy authorizes 14 to 21 days of paternity leave since November 2018, our data only covers up to August of 2018. Despite the recent increase in leave, we still believe there will be an increased effect of paid leave take-up for fathers as a result of changing attitudes towards PFL in the workplace following maternity leave expansions that occurred in 2015 for the Navy and Marine Corps and in 2016 for the Army and Air Force.

D. COMPARISON TO NORWAY

Dahl, Loken, Mogstad, & Salvanes (2016) conducted a study on Norway's expansion of paid maternity leave from 18 weeks to 35 weeks from 1987 to 1992. The policy change is similar to the military policy change in our study because both nearly

double the amount of maternity leave offered and wage replacement is 100 percent for mothers. Dahl et al. (2016) estimated that Norway's change in parental leave policy was associated with no change in the high school graduation rate, household earnings, or labor force participation in the short and long runs. The study also found little evidence that expanded parental leave policies had any effect on fertility, marriage or divorce. Also, mothers who were eligible for maternity leave in Norway were higher educated, married to higher educated men, and had higher household incomes than mothers who were ineligible for maternity leave (Dahl et al., 2016). This result differs from our study since maternity leave is available to all female service members, therefore, varying eligibility will not affect our estimates.

Dahl et al.'s (2016) study differs from any previous studies on parental leave because leave take-up and participation rates are essentially 100 percent. In our study, we will examine the amount of the leave take-up within various subgroups, though we expect minimal variation across demographics and some increased leave take-up in enlisted relative to officers. Another large policy difference from Dahl et al.'s study is that Norway did not offer any assistance for childcare for parents with children younger than the age of 2. In contrast, the U.S. military offers subsidized childcare for service members with children, which could positively contribute to service members decisions to start families while in the service.

E. "MOMMY EFFECTS"

Finally, a consideration when studying female labor force trends involves the often unknown and underestimated effects of motherhood. Kuziemko, Pan, Shen & Washington (2018) examine this phenomenon, which they dub the "mommy effects." Although modern women have surpassed men in education and human capital, gender gaps still remain among most developed countries.

The authors attribute this gap to the underestimation of employment costs related to motherhood, both in the short run and the long run. Across three cohorts, Kuziemko et al. (2018) estimated that American women were 25 to 40 percentage points less likely to work after motherhood. They further attributed some of this change to a shift in attitudes

towards labor participation of mothers and estimated that anti-work attitudes increased upon motherhood along with the unexpected demands of parenthood. These attitude estimates hold true when the average costs of motherhood (defined in the study as time, effort, and money to raise children while also working) have increased across cohorts. Any woman, regardless of pre-motherhood education or beliefs, can experience the "mommy effects" (Kuziemko et al., 2018). This adds another level of difficulty to predicting labor force outcomes after motherhood. Measuring retention could be more difficult in our study because the "mommy effects" may not appear until after the birth of a child when a mother experiences them. We account for retention at the year mark after a child is born, which may not fully capture the "mommy effects" due to the lead time required for service members to voluntarily leave the uniformed services.

III. METHODOLOGY

A. DATA DESCRIPTION

We analyzed two unique and distinct data sets separately. Our first data set is panel data from the Total Force Data Warehouse (TFDW). Our second data set is panel data from the Defense Manpower Data Center (DMDC). Tables 1 through 4 display summary statistics for TFDW and DMDC data. Both data sets consist of monthly snapshots for active duty service members from two years prior to any changes in maternity policy to approximately two years after initial policy implementation.

We limited our observations to service members younger than 50 years, to capture women of childbearing age, and to avoid capturing careerist behavior. We further constrained our observations to service members with time in service ranging from 3 to 12 years for all except Marine Corps leave analysis. This limitation captures service members at two major decision periods of service. The first decision period is whether or not to continue after initial service obligation, which is beyond four years on average. The second decision period is whether to remain for a career, which is between the 10- to 12-year mark. We used 12 years for the latter in order to include enlisted observations, which are typically limited to 4-year enlistment increments. In addition, we want to observe service-member retention decisions after completion of minimum service requirements and before they have reached retirement eligible paygrades. Additional controls included individual demographics such as age, gender, race, ethnicity, paygrade, marital status, time left to expiration of service, time in service, previous number of children, military spouse, unit location, occupational codes, education, and armed forces qualification test scores (TFDW) and general classification test scores (TFDW).

From fiscal years (FY) 2012 to FY18, federal law required the DoD to reduce end strength each fiscal year. Figure 4 displays active duty military end strength from FY12-18. The overall DoD drawdown occurred from FY12 through FY16. From FY17 to FY18, the DoD increased the number of active duty personnel. The drawdown did not occur uniformly across services and Figures 5 displays drawdown trends across fiscal years for

the individual services (USA, USAF, USMC, and USN). Most services experienced drawdown from FY12 to FY15 or FY16 with the exception of the Navy, which only experienced a drawdown in FY16.

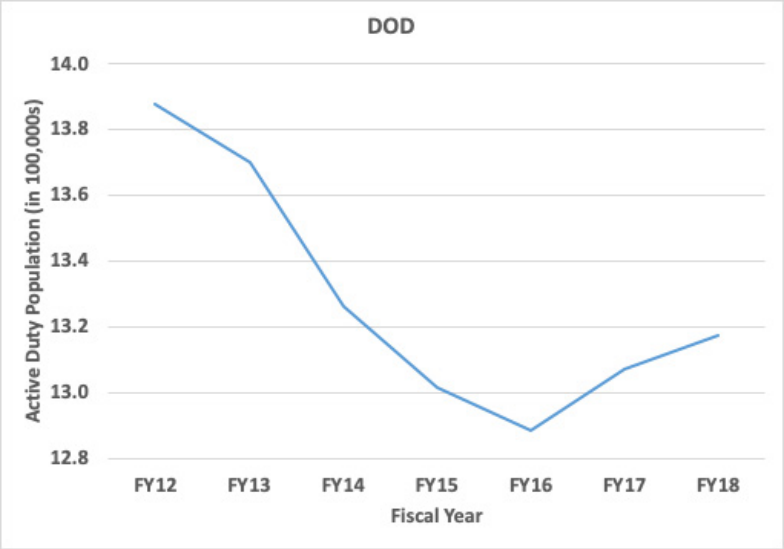

Figure 4. DoD Drawdown (FY12-FY18). Source: DMDC (2019).

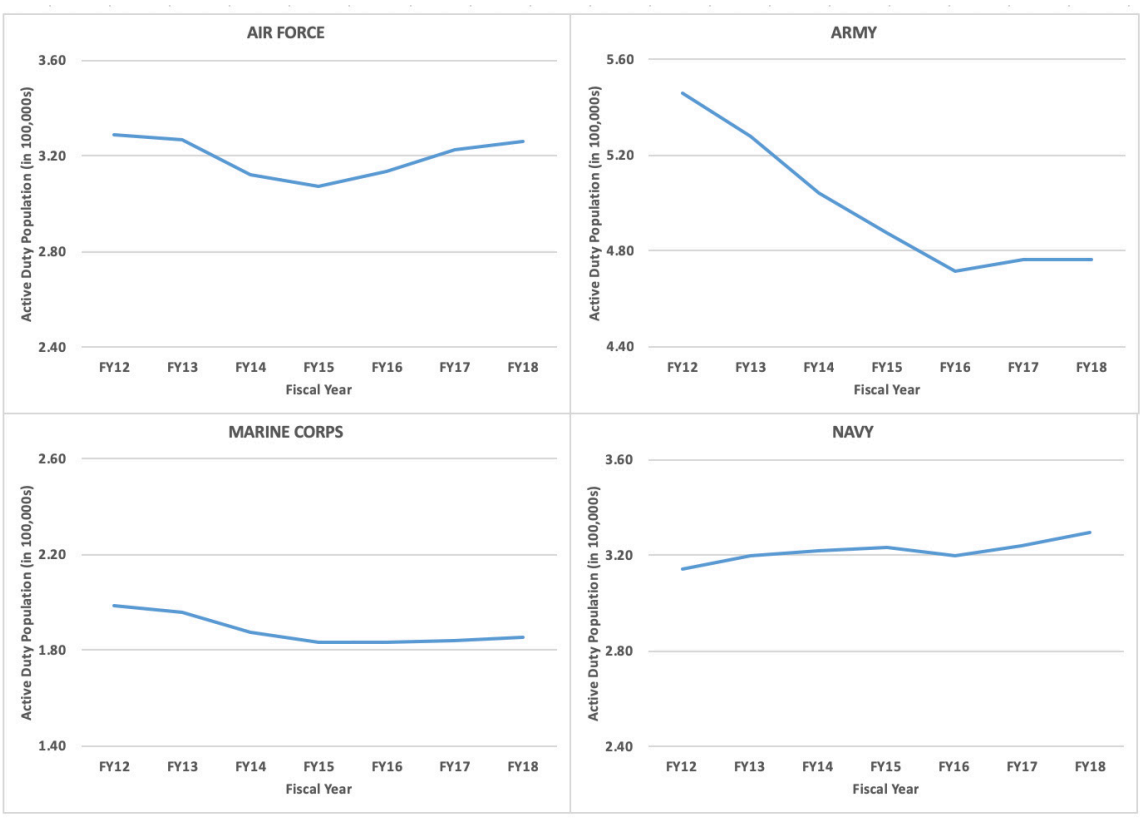

Figure 5. DoD Drawdown by Branch (FY12-FY18).
Source: DMDC (2019).

End Strength is the number of people the DoD is required to maintain, by service, and is measured on September 30, the last day of each FY. This creates a measurement problem since monthly totals of active-duty service members fluctuate above and below end strength caps during each FY. In order to account for monthly variation in the number of active duty service members, we developed a continuous drawdown control variable labeled *drawdown*. The variable is a fraction of the number of officers and enlisted by branch in a given month, in given year, over the maximum number of officers and enlisted in a given month for the duration of our data. Including *drawdown* in the model controls for variation in end strength at the monthly level vice the yearly level that is captured by simply accounting for FY end strength.

Another measure we controlled for in both data sets is military (or joint) spouse, because the portion of the female service member population married to another military

spouse is significant. Approximately 25.9 percent of females in the Marine Corps and 27.2 percent of females in all observed branches were married to a service member during the observation period. By comparison, the portion of male service members married to a service member is approximately 2 percent for Marines and 3.6 percent for males of all observed branches. The percentages increased for female and male service members that had a baby appear in the data. Approximately 38.1 percent of female Marines and 36.1 percent of females in all observed branches that had a baby were married to another service member. Males in the Marine Corps and males in all branches that had a baby and were married to another service member approximated to 4.4 percent and 4.6 percent, respectively.

1. TFDW Data Description

This data included nearly 13 million observations from January 2013 through August 2018 of active-duty Marines. With three- to twelve-years of time in service (TIS) constraints applied, the number of observations decreased to approximately 5 million. Different from the DMDC data set, TFDW data included monthly leave by type and amount used for each Marine, duty limitation type and duration, and dependent date of birth. Those added variables allowed us to conduct a sensitivity analysis on Marine leave usage during the 6-week, 18-week, and 12-week maternity policy periods and generate a more precise indicator variable for birth events. However, we acknowledge that there is likely some recording error due to the absence of leave observations for female Marines immediately following childbirth and the low number of recorded paternity leave observations of fathers during the 6-week maternity leave policy period. We applied several control variables to account for demographic variation within the Marine Corps, as depicted in Table 1 descriptive statistics. Table 1 also shows some additional controls we applied in our methodology: national unemployment rate, DoD military drawdown, and time relative to each Marine's end of active service date.

Table 1. Descriptive Statistics of Demographics for Marines, 3 to 12 Years in Service

	All Marines	Female Marines	Female Marines with Baby	Male Marines with Baby
Drawdown	0.950	0.949	0.949	0.952
	(0.023)	(0.022)	(0.023)	(0.023)
Unemployment Rate	5.453	5.383	5.482	5.640
	(1.165)	(1.158)	(1.128)	(1.140)
Time (Months) Left to	-20.734	-20.656	-19.390	-24.700
EAS	(14.758)	(14.392)	(13.478)	(14.322)
Age	25.799	25.555	25.356	26.793
	(3.672)	(3.581)	(3.428)	(3.578)
Female	0.076	1.000	1.000	0.000
	(0.265)	(0.000)	(0.000)	(0.000)
African American	0.103	0.158	0.166	0.097
	(0.304)	(0.365)	(0.372)	(0.295)
White	0.805	0.702	0.706	0.815
	(0.396)	(0.457)	(0.456)	(0.388)
Other	0.091	0.140	0.129	0.089
	(0.288)	(0.347)	(0.335)	(0.284)
Hispanic	0.164	0.238	0.242	0.155
	(0.370)	(0.426)	(0.428)	(0.362)
Officer	0.117	0.123	0.083	0.162
	(0.322)	(0.329)	(0.276)	(0.368)
Warrant Officer	0.004	0.004	0.003	0.005
	(0.061)	(0.060)	(0.058)	(0.073)
Married	0.590	0.522	0.781	0.957
	(0.492)	(0.499)	(0.414)	(0.203)
Time in Service	5.685	5.480	5.469	6.446
	(2.805)	(2.693)	(2.692)	(2.794)
Previous number of Kids	0.493	0.402	0.475	0.637
	(0.835)	(0.697)	(0.678)	(0.816)
Military Spouse	0.048	0.259	0.381	0.045
	(0.214)	(0.438)	(0.486)	(0.206)
Some College	0.030	0.047	0.046	0.034
	(0.170)	(0.213)	(0.210)	(0.181)
College Degree	0.128	0.147	0.110	0.172
	(0.334)	(0.354)	(0.313)	(0.377)
Armed Forces	58.332	55.241	55.539	55.827
Qualification Test Score	(25.035)	(24.686)	(21.985)	(26.785)
General Classification	111.083	105.817	104.010	111.849
Test Score	(12.444)	(12.399)	(11.643)	(12.588)
Observations	5246105	399728	2646	32273

Mean coefficients; SD in parentheses. Observation period is January 2013 to August 2018.

Unique to the TFDW data set, is the end of active service (EAS) information. EAS refers to the end of an initial service contract for service members. Using the EAS date, we generated the control variable *timetoend* to measure the time a Marine has until their EAS. This numeric variable computed the difference in months between the current observation month of a Marine and the months left until their EAS. Also, we created the variable *timetoendsq* to control for the quadratic relationship. Since Marine officers do not maintain an EAS after their initial service obligation, we assigned the mean value of *timetoend* in order to account for those missing observations. We used this variable to establish a continuous value relative to the individual reaching their EAS. Controlling for time left until a Marine's EAS is important because it represents a Marine's end of active service obligation and accounts for variation in choices related to reenlistment or career designation for officers. On average, Marines are required to make career or service continuation decisions in advance. We estimate the lead time for these decisions' ranges from 6 to 12 months.

For our analysis of leave used by males and females in the year following a birth event, we selected the five most frequently observed leave types: maternity, sick, annual combat, and permissive temporary additional duty (PTAD). Table 2 shows descriptive statistics of these leave types and the combinations we generated to depict parental leave and any or all leave indicators and quantity variables. The any leave taken indicator includes all leave types for females barring combat leave, and all leave types for males barring sick leave. The parental leave indicator includes sick maternity and PTAD for females, and PTAD for males. The all leave variables are quantity variables of total days of leave used and include the same leave types for females and males as the any leave taken indicator.

Maternity leave, also represented in Table 2, is indicated by the maternity or sick leave type. Prior to 2016, the Marine Corps coded all maternity leave under the sick leave type. In 2016, the Marine Corps generated a maternity-specific leave type to supersede the sick leave type for maternity purposes. This change caused overlap and/or duplication of maternity and sick leave used for some individuals in our data set. We addressed this potential measurement error by first accounting for maternity and sick leave separately,

and then removing duplicate occurrences of sick and maternity leave, giving precedence to maternity leave. In addition, we recognized occurrences where PTAD was the only leave type recorded postpartum. In these circumstances, we included PTAD as a maternity leave indicator when neither sick nor maternity leave types were present.

Leave types related to birth events for fathers included PTAD, annual and combat leave, since there is no paternity leave type for the Marine Corps. Of note, in the 6-week policy period or the first two years of our data, there are only two observations of PTAD leave used by males immediately following a birth event. This is inconsistent with the other policy periods where PTAD is consistently observed in the data following a birth event. Of note, we did not have deployment status codes to indicate whether or not a male service member was deployed at the time of birth or in the year following. However, we include combat leave since it is used in priority over annual leave following return from deployment. Therefore, we should capture leave used by fathers whose child(ren) were born before, after or during a deployment. Paternity leave and PTAD for fathers are used synonymously in our study.

We coded combat and annual leave separate of other leave types to estimate additional combat and annual leave used in the year following a birth event. The purpose of showing annual leave in addition to any parental leave used was to measure how much chargeable paid leave Marines used to augment limitations on parental leave. Also, since combat leave amounts are used in priority over annual leave, we show combat leave amounts separate of parental and annual leave. Table 2 depicts descriptive statistics of the parental leave and all leave categories previously described for mothers and fathers during two major periods: 3 months and 12 months following a dependent child's birth month.

Table 2. Descriptive Statistics of Leave Variables for Marines

	Maternity 0-3 Months	Paternity 0-3 Months	Maternity 0-12 Months	Paternity 0-12 Months
Any Leave Taken Indicator	0.193 (0.394)	0.212 (0.409)	0.068 (0.251)	0.071 (0.257)
Parental Leave Taken Indicator	0.146 (0.353)	0.083 (0.276)	0.051 (0.221)	0.028 (0.165)
All Leave Used by Mothers, All Policy Periods	62.022 (54.027)		62.138 (54.076)	
Maternity/Sick Leave Used by Mothers, All Policy Periods	46.649 (48.924)		46.755 (48.957)	
All Leave Used by Fathers, All Policy Periods		25.384 (17.389)		25.410 (17.385)
Permissive TAD Leave Used by Fathers, All Policy Periods		3.960 (6.592)		3.967 (6.604)
Observations	18473	196570	52960	589007

Mean coefficients; SD in parentheses. Observation period is January 2013 to August 2018. Averages are based on monthly observations of leave used. Indicator Variables are binary. Quantity variables are measured in days. The All Leave or Any Leave variables measure annual leave with parental leave. Parental leave includes maternity, sick, combat and permissive TAD. The sick leave category was used as maternity leave until early 2016, when the maternity leave type was created. Paternity leave is represented by the permissive temporary additional duty (TAD) leave type, since no paternity leave type exists.

Our data covers three periods of maternity leave policy, with the highest number of observations concentrated in the 6-week policy period, then the 18-week policy period, and finally the 12-week policy period. Table 3 shows percentages of marines, female marines, and female marines that had a baby during each policy period. To add more 6-week or 12-week maternity leave policy observations, we could extend the period of observation to before January 2013 or after August 2018. However, in November 2018, the Marine Corps updated its parental leave policy by extending paternity leave to 14 days and adding primary/secondary caregiver leave. With those recent changes considered, the 12-week maternity leave policy effects may be best observed up until those additional policies were announced or implemented.

Table 3. Descriptive Statistics of Policy Periods for Marines, 3 to 12 Years in Service

	All Marines	Female Marines	Female Marines with Baby
6-week policy	0.368	0.346	0.375
	(0.482)	(0.476)	(0.484)
12-week policy	0.296	0.325	0.278
	(0.456)	(0.468)	(0.448)
18-week policy	0.336	0.330	0.347
	(0.472)	(0.470)	(0.476)
Baby Appeared	0.007	0.007	1.000
	(0.081)	(0.081)	(0.000)
Observations	5246105	399728	2646

Mean coefficients; SD in parentheses. Observation period is January 2013 to August 2018. Baby appeared if dependent date of birth occurred during data observation period. Baby did not appear if date of birth occurred outside of observation period.

2. DMDC Data Description

This data set included approximately 32 million observations from January 2013 through December 2017 for each service member with a dependent within each branch (USA, USAF, USMC, USN). The number of observations decreased to less than 15 million with time-in-service constraints of three to five years and age constraints of younger than 50 years. Our DMDC data set is limited to service members who have at least one of any type of dependent. For example, our data may include observations for a service member who is not married but has a dependent mother. Therefore, our primary comparison group is service members who do not have a dependent baby or any dependent children but have at least one other dependent type during the observation period (e.g., spouse, mother, or grandfather). As depicted in Table 4 descriptive statistics, we applied nearly identical control variables to the DMDC data to account for demographic variation among the services, national unemployment rate and DoD military drawdown.

Table 4. Descriptive Statistics All Services, 3 to 12 Years in Service

	All Branches	Females in All Branches	Females in All Branches with Baby	Females in Army & Air Force with Baby	Females in Navy & Marine Corps with Baby
Baby Appeared	0.0180	0.0172	1.0000	1.0000	1.0000
	(0.1329)	(0.1301)	(0.0000)	(0.0000)	(0.0000)
Drawdown	0.8827	0.8921	0.8951	0.8704	0.9382
	(0.1033)	(0.0995)	(0.0984)	(0.0951)	(0.0887)
Unemployment	5.6922	5.6620	5.5511	5.5851	5.4917
Rate	(1.1066)	(1.1049)	(1.0531)	(1.0622)	(1.0344)
Age	29.4021	29.1024	27.3477	27.7973	26.5626
	(4.6472)	(5.0205)	(4.0603)	(4.0494)	(3.9587)
Female	0.1328	1.0000	1.0000	1.0000	1.0000
	(0.3394)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
African	0.1770	0.3234	0.2643	0.2843	0.2294
American	(0.3817)	(0.4678)	(0.4410)	(0.4511)	(0.4204)
White	0.6879	0.4912	0.5485	0.5598	0.5287
	(0.4633)	(0.4999)	(0.4977)	(0.4964)	(0.4992)
Other	0.1350	0.1855	0.1872	0.1559	0.2419
	(0.3418)	(0.3887)	(0.3901)	(0.3628)	(0.4283)
Hispanic	0.1386	0.1534	0.1483	0.1177	0.2017
	(0.3456)	(0.3604)	(0.3554)	(0.3223)	(0.4013)
Officer	0.1503	0.1518	0.1905	0.2264	0.1278
	(0.3574)	(0.3589)	(0.3927)	(0.4185)	(0.3339)
Warrant	0.0095	0.0035	0.0018	0.0026	0.0005
	(0.0970)	(0.0589)	(0.0429)	(0.0511)	(0.0221)
Married	0.8893	0.6840	0.7793	0.8049	0.7348
	(0.3138)	(0.4649)	(0.4147)	(0.3963)	(0.4415)
Total active	89.8302	86.4192	75.4906	78.1228	70.8948
military service	(31.1562)	(31.3198)	(30.2959)	(30.5588)	(29.2704)
Previous	1.6097	1.4616	0.6139	0.6668	0.5215
Number of	(0.9163)	(0.7916)	(0.7772)	(0.8151)	(0.6967)
Children					
Military Spouse	0.0676	0.2716	0.3605	0.3860	0.3160
	(0.2510)	(0.4448)	(0.4802)	(0.4868)	(0.4649)
Some College	0.1530	0.2074	0.1594	0.2012	0.0864
	(0.3600)	(0.4055)	(0.3660)	(0.4009)	(0.2810)
College Degree	0.1241	0.1273	0.1376	0.1562	0.1051
	(0.3297)	(0.3333)	(0.3445)	(0.3631)	(0.3068)
Observations	14729324	1956646	33691	21422	12269

Mean coefficients; SD in parentheses. Observation period is January 2013 to December 2017.

A few shortfalls with the all-service data are the lack of service member observations without dependents, dependent date of birth, deployment status, expiration of service date, and leave data. Since services collect and maintain data differently, poor standardization limits the type of aggregated data the DMDC has access to. Therefore, retention is our only estimated outcome using this data.

In order to measure birth occurrences without date of birth, we used dependent age information to approximate when a baby appeared in the data, which occurred in 1.8 percent of the observations. Typically, dependent babies were added into the data anywhere from 3- to 6- months of age. Because the baby appeared indicator variable is an approximation, we did not generate a pregnancy indicator variable. Also, without service member EAS information, we could not apply the same methodology in the TFDW data to control for time left until EAS. Without this control, we could potentially be understating the magnitude of an individuals' likelihood to remain in the military.

B. METHODOLOGY

1. TFDW Data Methodology

We employed three methods to observe leave, retention, pregnancy, and birth outcomes among Marines: Regression Discontinuity (RD) design, First Difference (FD) and Difference-in-Difference (DiD). To limit capturing behaviors of routine first-term or mid-career departures and careerists, we applied age (younger than 50 years) and time in service constraints (3 to 12 years). We did not apply time in service constraints for leave estimates, since similar behaviors would not likely effect how Marines executed leave in conjunction with the birth of a child.

We used (FD) to measure the treatment effects of additional maternity leave under the 18- and 12-week policy changes relative to the 6-week maternity leave control group. All leave models were limited to observations of females or males within the first year after a dependent baby appeared. Our primary comparison group was Marines who were in a maternity or paternity status (12-months following a dependent baby DOB) in the 6-week policy period. We applied the FD framework to estimate probability and quantity outcomes for all leave used and parental leave used. Our primary FD leave model is below:

$$Y_i = B_0 + B_1 * L12weeks_i + B_2 * L18weeks_i + X_i\,\lambda + \varepsilon_i \quad (1)$$

where Y_i is a probability outcome of the likelihood that a Marine is on leave (either any leave or parental leave) during the year after the birth of a dependent child, B_1 is the estimated coefficient for the 18-week policy period effect per *i* (individual), B_2 is the estimated coefficient for the 12-week policy period effect per individual, X_i represent a vector of control variables, and ε_i is the error term. We estimate outcomes separately for male and female Marines. We use the same model to estimate the number of days that a Marine is on leave each month (either any leave or parental leave) during the year after the birth of a dependent child.

We also used an RD design to estimate leave taking behaviors relative to the discontinuity points of 18-week maternity policy implementation (July 2015) and 12-week maternity policy implementation (February 2016). These variables differ from the other 12-week and 18-week maternity leave policy indicators because they do not include the retroactive leave periods. Our RD leave model is below:

$$\mathrm{Y_i} = \mathrm{B_0} + \mathrm{B_1} * announce18_i + \mathrm{B_2} * timerel18_i + B_3 * (announce18_i * timerel18_i) + B_4 * announce12_i + B_5 * (announce12_i * timerel18_i) + \mathrm{X_i}\,\lambda + \varepsilon_i \quad (2)$$

where Y_i is a probability outcome of the likelihood that a Marine is on leave, B_1 is the estimated 18-week maternity leave policy announcement indicator per individual, B_2 is the time relative to the 18-week policy announcement per individual, B_3 is the interaction between the 18-week leave policy indicator and the time relative to the 18-week policy announcement per individual, B_4 is the estimated 12-week maternity leave policy announcement indicator per individual, B_5 is the interaction between the 12-week leave policy indicator and the time relative to the 18-week policy announcement per individual, $X_i\,\lambda$ represents all covariate variables, and ε_i is the error term.

To estimate birth, pregnancy, and retention outcomes for mothers who received increased maternity leave we used FD, DiD and RD frameworks. In order to best represent the knowledge or expectation of additional maternity leave, we further divided the 6-, 12- and 18-week policy periods to account for changes in females' leave expectations. The

periods consist of females who expected a certain amount of maternity leave and were subject to policy changes that provided the same or a greater amount of maternity leave: expected 6 weeks and received 18 weeks of leave; expected 18 weeks and received 18 weeks of leave; and expected 12 weeks and received 12 weeks of leave. Our control group consisted of females who expected to receive 6-weeks of maternity leave and received 6-weeks of maternity leave.

The following FD model estimated birth outcomes for female Marines:

$$Y_i = B_0 + B_1 * Expect06Get18_i + B_2 * Expect12Get12_i + B_3 * Expect18Get18_i + X_i\lambda + \varepsilon_i \quad (3)$$

where Y_i is a probability outcome of the likelihood that a female Marine gives birth with an expectation for maternity leave during a specific policy period, B_1 is the estimated coefficient per i (individual) who expected to receive 6 weeks of maternity leave and instead received 18 weeks of maternity leave, B_2 is the estimated coefficient per individual who expected 12 weeks of maternity leave and received 12weeks, B_3 is the estimated coefficient per individual who expected to receive 18 weeks of maternity leave and received 18 weeks, $X_i\lambda$ represents all covariate variables, and ε_i is the error term. We employ this model with and without covariates.

Using model (3), we further restricted data observations to female Marines who had a baby or never had a baby during the observation period and did not have previous children or only had only one previous child. This added restriction allowed us to estimate policy effects on birth outcomes for relatively new mothers or mothers who were still likely to have additional children. The comparison group consisted of female Marines who expected and received 6-weeks of maternity leave, who had no previous births appear during the observation period and either had no previous children or only one child born prior to the observation period. We then estimated birth outcomes for mothers during the observation period with either no previous children or one previous child, who expected 6, 12, or 18 weeks of maternity leave and received 12 or 18 weeks of maternity leave.

Our next models estimated pregnancy outcomes during the expectation and policy periods, which we believed would be more valuable in determining estimated effects that

maternity leave policy changes have on fertility decisions of female Marines. With precise dependent children DOBs, we were able to estimate pregnancy start dates using an average gestational period of 268 days (Jukic, Baird, Weinberg, McConnaughey, & Wilcox, 2013). Also, to add pregnancies that did not result in a birth event, we accounted for the first observation of pregnancy using limited duty status indications for those individuals without a subsequent dependent child DOB. Similar to the birth outcome method, our pregnancy model began with a broad reference group of pregnant females who expected to receive 6-weeks of maternity leave and are observed in the 6-week maternity leave policy period. Then we further limited the observations to include only women with a pregnancy or without a pregnancy indication and with no previous children or one previous child during the observation period. We applied these additional constraints to our second pregnancy model, which allowed us to estimate pregnancy outcomes for new mothers with no previous pregnancies or children and mothers who were still likely to become pregnant again. Our control group for this model was females who expected and received 6-weeks of maternity leave, and who had no previous children or only one child born prior to the observation period.

The following FD model estimated policy effects on women's decisions to become pregnant:

$$Y_i = B_0 + B_1 * Expect06Get18_i + B_2 * Expect12Get12_i + B_3 * Expect18Get18_i + X_i\lambda + \varepsilon_i \quad (4)$$

where Y_i is a probability outcome of the likelihood that a female Marine is pregnant with an expectation for maternity leave during a specific policy period, B_1 is the estimated coefficient per *i* (individual) who expected to receive 6 weeks of maternity leave and instead received 18 weeks of maternity leave, B_2 is the estimated coefficient per individual who expected 12 weeks of maternity leave and received 12 weeks, B_3 is the estimated coefficient per individual who expected to receive 18 weeks of maternity leave and received 18 weeks, $X_i\lambda$ represents all covariate variables, and ε_i is the error term. We employ this model with and without covariates.

Our next model used a difference in difference approach (DiD), which we also applied to the all service data in Section 2. We limited our observations to male and female Marines who have a baby during the observation period or never had a baby during the observation period. Our goal was to exclude observations from the comparison group of Marines who are likely done having children and would not make retention decisions based upon maternity leave policy changes. Our DiD framework involved interacting each expectation/policy period with birth outcomes. By including this interaction, we could estimate retention behaviors for Marines who had babies in each of the expectation and policy periods.

We applied the following model to male and female observations separately to compare retention estimates by gender for the separate expectation/policy periods. The estimated effects on males served as a placebo to female retention behavior beyond the maternity leave policy changes because men were not provided any added leave benefits.

$$Y_i = B_0 + B_1 * Baby_i + B_2 * Expect06Get18_i + B_3 * Expect06Get18_i * Baby_i + B_4 * Expect12Get12_i + B_5 * Expect12Get12_i * Baby_i + B_6 * Expect18Get18_i + B_7 * Expect18Get18_i * Baby_i + X_i\lambda + \varepsilon_i \quad (5)$$

where Y_i is a probability outcome of the likelihood that a Marine is still present in the data in the next 12 months, B_1 is the estimated effect of having a baby per individual, B_2 is estimated effect of the expect 6 weeks and get 18 weeks of leave time period per individual, B_3 is the estimated interaction between the appearance of a baby during the expect 6 weeks and get 18 weeks of leave per individual, B_4 is estimated effect of the expect 12 weeks and get 12 weeks of leave time period per individual, B_5 is the estimated interaction between the appearance of a baby during the expect 12 weeks and get 12 weeks of leave per individual, B_6 is estimated effect of the expect 18 weeks and get 18 weeks of leave time period per individual, B_7 is the estimated interaction between the appearance of a baby during the expect 18 weeks, get 18 weeks of leave per individual, $X_i\lambda$ represents all control variables, and ε_i is the error term. We employ this model with and without covariates.

We used an RD design as the final method to analyze female Marine retention behaviors. Because maternity leave policies were unexpected or could not be predicted, it is highly unlikely that females self-selected into specific policy periods. Also, females are

typically unable to manipulate the birth of their child (without medical intervention). Therefore, the discontinuous effects should be sharp or apparent on either side of the policy implementation date (not including observations in the retroactive policy period). We estimate retention effects at the 6-month postpartum and 12-month postpartum periods for the policy increase and decrease periods:

$$Y_i = B_0 + B_1 * L18weeks_i + B_2(t = DOB_i - effective\ date_{18}) + X_i\lambda + \varepsilon_i \quad (6)$$

where Y_i is a probability outcome of the likelihood that a female Marine is still present in the data in the next 12 months, B_1 is the estimated coefficient for the 12-week policy period effect per individual, B_2 is the estimated interaction between the appearance of a baby relative to the 12-week retroactive effective date and branch of service per individual, $X_i\lambda$ represents all covariate variables, and ε_i is the error term. We employ this model with and without covariates.

The following RD model is specific to the reduction from 18 to 12 weeks of maternity leave:

$$Y_i = B_0 + B_1 * L12weeks_i + B_2(t = DOB_i - effective\ date_{12}) + X_i\lambda + \varepsilon_i \quad (7)$$

where Y_i is a probability outcome of the likelihood that a female Marine is still present in the data in the next 6 or 12 months, B_1 is the estimated coefficient for the 12-week policy period effect per individual, B_2 is the estimated interaction between the appearance of a baby relative to the 12-week retroactive effective date per individual, $X_i\lambda$ represents all covariate variables, and ε_i is the error term. We employ this model with and without covariates.

2. DMDC Data Methodology

We employed two methods to observe retention outcomes among the services: Regression Discontinuity (RD) design and Difference-in-Difference (DiD). These methods included age (younger than 50 years) and time in service constraints (3 to 12 years), to limit capturing behaviors of routine first-term or mid-career departures and careerists.

First, we estimated retention of service members at the 6- and 12-month points using a sharp RD design. Both policy implementations added a retroactive time period that

extended the increased maternity leave benefits to some female service members. For the Navy and Marine Corps policy increase from 6 to 18 weeks of maternity leave, we selected the discontinuity month as January 2015, since the retroactive effective date began January 1, 2015. The 6- to 12-week maternity leave increase occurred on February 2, 2016, for the Army and Air Force. Therefore, we established the discontinuity month as December 2015, since the retroactive effective period extends to mothers on maternity leave and annual leave associated with maternity leave at policy implementation.

Simultaneous to the policy increase for the Army and Air Force was the decrease from 18- to 12-weeks of maternity leave for the Navy and Marine Corps. In order to capture the retention effects of this policy, we established a separate RD design for time relative to the decrease in maternity leave. For the Navy and Marine Corps, the policy decrease effective date was for women who were pregnant on or after March 4, 2016, which gave female Sailors and Marines approximately a month to establish pregnancy before losing the additional 6 weeks of maternity leave. Our estimated RD cutoff date for the policy decrease was December 2016, which accounted for pregnancies and births still covered under the 18-week maternity leave policy.

We graphically depicted the sharp RD estimates without covariates for males and females in all services, and then coupled Army and Air Force and Navy and Marine Corps graphs to distinguish between the two different policy increases. Our RD regression models are below, with our preferred RD models containing covariates:

$$\begin{aligned} Y_i = {} & B_0 + B_1 * L18weeks_i + B_2 * L12weeks_i \\ & + B_3[(t = baby_i - retroeffective\ date_{18}) * Branch_i] \\ & + B_4[(t = baby_i - retroeffective\ date_{12}) * Branch_i] \\ & + X_i\,\lambda + \varepsilon_i \end{aligned} \quad (1)$$

where Y_i is a probability outcome of the likelihood that a service member is still present in the data in the next 12 months, B_1 is the estimated coefficient for the 18-week policy period effect per *i* (individual), B_2 is the estimated coefficient for the 12-week policy period effect per individual, B_3 is the estimated interaction between the appearance of a baby relative to the 18-week retroactive effective date and branch of service per individual, B_4 is the estimated interaction between the appearance of a baby relative to the 12-week retroactive

effective date and branch of service per individual, $X_i\,\lambda$ represent all control variables, and ε_i is the error term. We employ this model with and without covariates.

The following RD model applies only to the Navy and Marine Corps 18- to 12-week maternity policy reduction:

$$Y_i = B_0 + B_1 * L12weeks_i + B_2[(t = baby_i - retroeffective\ date_{12}) * Branch_i] + X_i\,\lambda + \varepsilon_i \quad (2)$$

where Y_i is a probability outcome of the likelihood that a service member is still present in the data in the next 6 months, B_1 is the estimated coefficient for the 12-week policy period effect per individual, B_2 is the estimated interaction between the appearance of a baby relative to the 12-week retroactive effective date and branch of service per individual, $X_i\,\lambda$ represents all covariate variables, and ε_i is the error term. We employ this model with and without covariates.

Our next methodology used a difference in difference (DiD) approach. We limited our observations to men and women who have a baby during the observation period or never had a baby during the observation period. This additional restriction removed observations from the comparison group of service members with older children born before our observation period to exclude service members who are likely done having children and would not make retention decisions based upon maternity leave policy changes.

As previously demonstrated in the TFDW methodology, we further divided the 6-, 12- and 18-week policy periods to account for the changes in service member leave expectations. The groups included service members who expected a certain amount of maternity leave and were subject to policy changes that provided the same or a greater amount of maternity leave: expected 6 weeks and received 18 weeks of leave (USN and USMC only); expected 18 weeks and received 18 weeks of leave (USN and USMC only); expected 6 weeks and received 12 weeks of leave (USA and USAF only); and expected 12 weeks and received 12 weeks of leave (all services). The reference group consisted of service members who expected to receive 6-weeks of maternity leave and are observed in the 6-week maternity leave policy period. Our DiD framework involved interacting the

four expectation/policy periods with having a baby. By including this interaction, we could estimate retention behaviors for services members who had babies in each of the expectation and policy periods.

We applied the following model to male and female observations separately to compare retention estimates by gender for the separate expectation/policy periods and their interactions with having a baby. The estimated effects on males served as a placebo to female retention behavior beyond the maternity leave policy changes because men were not provided any added leave benefits.

The following DiD model is our preferred model and method to estimate policy effects on retention:

$$\begin{aligned} Y_i = B_0 + B_1 * Baby_i + B_2 * Expect06Get12_i + B_3 * Expect06Get12_i * Baby_i + B_4 \\ * Expect06Get18_i + B_5 * Expect06Get18_i * Baby_i + B_6 * Expect12Get12_i \\ + B_7 * Expect12Get12_i * Baby_i + B_8 * Expect18Get18_i + B_9 \\ * Expect18Get18_i * Baby_i + X_i\,\lambda + \varepsilon_i \end{aligned} \quad (3)$$

where Y_i is a probability outcome of the likelihood that a service member is still present in the data in the next 12 months, B_1 is the estimated effect of having a baby per individual, B_2 is estimated effect of the expect 6 weeks and get 12 weeks of leave time period per individual, B_3 is the estimated interaction between the appearance of a baby during the expect 6 weeks, get 12 weeks of leave per individual, B_4 is estimated effect of the expect 6 weeks and get 18 weeks of leave time period per individual, B_5 is the estimated interaction between the appearance of a baby during the expect 6 weeks, get 18 weeks of leave per individual, B_6 is estimated effect of the expect 12 weeks and get 12 weeks of leave time period per individual, B_7 is the estimated interaction between the appearance of a baby during the expect 12 weeks, get 12 weeks of leave per individual, B_8 is estimated effect of the expect 18 weeks and get 18 weeks of leave time period per individual, B_9 is the estimated interaction between the appearance of a baby during the expect 18 weeks, get 18 weeks of leave per individual, $X_i\,\lambda$ represents all control variables, and ε_i is the error term. We employ this model with and without covariates.

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IV. RESULTS

A. TFDW RESULTS

The Marine Corps data allowed us to estimate retention, birth, pregnancy, and leave taking outcomes for maternity leave policy changes, except for the increase from 6 to 12 weeks, which affected the Army and Air Force only. A drawback of only observing these outcomes for the Marine Corps is that it is the smallest service and is a homogenous organization from a cultural perspective. Also, it has the smallest concentration of females among the services, which limits the number of observations of all outcomes and any potentially outliers will have a greater impact on estimates. Despite these limitations, our estimates indicate significant effects from the maternity leave policy changes on all outcomes.

1. Leave Outcomes

Table 5 represents the RD estimates of the likelihood of mothers and fathers being on leave (parental or any leave) in the expanded maternity leave periods relative to the time of the maternity leave changes. Directly following the 18-week maternity policy announcement, males were 5-percentage points more likely to use any leave in the paternity period, while females were 3.3-percentage points and 3.4-percentage points more likely to use parental leave and any leave respectively during the maternity period. Males were also 6.7-percentage points more likely to use parental leave and 4.1-percentage points more likely to use any leave following the 12-week maternity policy announcement. The sharp discontinuity at both maternity leave policy announcements indicated that any increases in parental leave used by mothers and fathers was a reaction to the new policies and not a summative effect of attitude changes to leave-taking over time relative to the policy announcements. This can be inferred from the relatively flat slopes of the coefficients of the policy announcement variables interacted with the time relative to the 18-week announcement.

Table 5. Regression Discontinuity: Leave Outcomes, 12 Months after Child DOB

	Male		Female	
	(1)	(2)	(3)	(4)
	Parental	Any Leave	Parental	Any Leave
Announcement of 18-week Policy	-0.003**	0.050***	0.033***	0.034***
	(0.001)	(0.002)	(0.008)	(0.009)
Time relative to 18-week leave increase	0.001***	-0.004***	0.002+	-0.000
	(0.000)	(0.000)	(0.001)	(0.001)
Announcement of 12-week Policy	0.064***	0.041***	0.012	0.036
	(0.001)	(0.002)	(0.057)	(0.060)
Announcement of 18-week Policy=1 X Time relative to 18-week leave increase	0.006***	0.002**	-0.003	-0.001
	(0.000)	(0.001)	(0.002)	(0.002)
Announcement of 12-week Policy=1 X Time relative to 18-week leave increase	-0.001***	0.004***	-0.001	-0.001
	(0.000)	(0.000)	(0.007)	(0.008)
Married	0.025***	0.028***	-0.011***	-0.016***
	(0.001)	(0.001)	(0.003)	(0.003)
Military Spouse	-0.002+	-0.006***	-0.007*	-0.008*
	(0.001)	(0.001)	(0.003)	(0.004)
Constant	0.028	1.478***	0.280	1.541***
	(0.087)	(0.144)	(0.215)	(0.253)
Observations	589007	589007	29601	29601
R^2	0.048	0.047	0.072	0.087

Standard errors in parentheses. Comparison group is leave taken during the 6-week maternity leave policy period. Covariates include monthly drawdown, monthly unemployment rate, individual months, months to end of active service, months to end of active service quadratic, officers, warrant officers, occupational specialty, unit location, race, ethnicity, number of children, pay grade, marital status, military spouse, education levels, and military test scores. Models (1) and (2) show leave outcomes for males in a paternity status. Models (3) and (4) show leave outcomes for females in a maternity status.
$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

a. Maternity Leave Outcomes

Table 6 represents the estimated leave-taking outcomes for mothers in a maternity status or the first 12 months after a dependent child's birth month. There were instances of mothers without any leave recorded following a birth event, which we believe may be an administrative error. For example, a mother took convalescent and/or maternity leave; however, it was not recorded for whatever reason. There is less incentive to be accurate with convalescent and maternity leave because they are non-chargeable leave types, so they do not

affect pay or annual leave amounts. We noticed this anomaly more frequently during the 6-week maternity leave policy period relative to the 12- and 18-week periods. The observations of no-leave taking were included in the leave regression estimates; however, we display them separately in Figures 6–11 in order to distinguish behaviors of leave-takers.

Table 6. First Difference: Leave-Taking Outcomes for Marine Mothers within 12 Months of Dependent Birth

	All Leave		All Parental Leave	
	(1) Percent	(2) Quantity	(3) Percent	(4) Quantity
12-week policy	0.041***	19.344***	0.031***	19.249***
	(0.007)	(3.480)	(0.006)	(2.892)
18-week policy	0.024***	55.065***	0.037***	59.401***
	(0.005)	(2.638)	(0.004)	(2.171)
Officer	-0.102	20.315	-0.114+	36.105+
	(0.070)	(28.717)	(0.068)	(21.320)
Warrant Officer	-0.227**	85.059*	-0.235***	117.476***
	(0.072)	(43.282)	(0.069)	(35.072)
African American	0.006*	-2.632	0.004+	-2.230
	(0.003)	(1.926)	(0.003)	(1.715)
Other	0.007*	-1.893	0.003	-3.283+
	(0.003)	(2.175)	(0.003)	(1.924)
Hispanic	0.007**	-1.228	0.005*	-1.110
	(0.002)	(1.643)	(0.002)	(1.440)
Married	-0.016***	3.888*	-0.010***	2.866+
	(0.002)	(1.741)	(0.002)	(1.504)
Military Spouse	-0.005+	-1.562	-0.004+	-0.675
	(0.003)	(1.883)	(0.002)	(1.683)
Constant	1.478***	336.544***	0.152	97.617
	(0.157)	(72.618)	(0.107)	(61.810)
Observations	52960	4704	52960	4704
R^2	0.097	0.428	0.076	0.455

Standard errors in parentheses. Observations are limited to females in a maternity status, which is 12 months from baby date of birth. Comparison group is females in a maternity status during the 6-week policy period. Models (1) and (2) include all leave type observations, which are maternity, sick, annual, and permissive TAD. Models (3) and (4) include only parental leave type observations for females, which are maternity, sick and permissive TAD. The models (1) and (3) outcome is binary and the models (2) and (4) outcome is quantity in days. Covariates include individual months, months to end of active service, months to end of active service quadratic, officers, warrant officers, age, race, ethnicity, occupational specialty, unit location, previous number of children, marital status, military spouse, education, and military classification test.
$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Table 6, we estimated positive and significant increases in the percent and quantity of leave taken following the maternity leave policy changes. The control group is mothers in a maternity status during the 6-week maternity leave policy period. Relative to mothers in the control group, mothers in the 12- and 18-week policy periods are 4.1-percentage points and 2.4-percentage points more likely to take any leave (annual, sick, maternity, or PTAD) following a birth event, and 3.1-percentage points and 3.7-percentage points more likely to take parental leave (maternity, sick, or PTAD) following a birth event. Relative to mothers in the 6-week policy period, mothers in the 12- and 18-week policy periods take 19.3 and 55.1 more days of any leave following a birth event, and 19.2 and 59.4 more days of parental leave following a birth event. We expected leave-taking percentages and quantities to be greater under the 18-week maternity leave policy period because more leave and the flexibility of when to take leave were available. During the 18-week policy period, female Marines were required to take the 6 weeks of convalescent leave immediately following childbirth (like the 6- and 12-week policy periods), but they also had the flexibility to intersperse the remaining 12 weeks of maternity leave in the year following childbirth. Mothers during the 12-week policy period were not afforded this flexibility, since the additional 6 weeks of maternity leave could only be taken immediately following the 6-week convalescent leave period. During the 18-week policy period, mothers' quantity of parental leave increased by a greater magnitude than mothers' quantity of all leave used for the same period. This could suggest that mothers diminished the amount of annual leave they used in the year following the birth of a child. For example, mothers replaced the annual leave they took on top of the 6-week maternity leave with the additional maternity leave they received in the 18-week policy period. This anomaly is also represented graphically in Figures 7 and 9.

Figures 6 through 11 display quantities of leave taken by mothers each month in the year following a birth event. All figures separate quantities of leave taken for enlisted Marines and Marine officers, since we observed more leave taking by enlisted versus officers, overall. During all maternity leave policy periods, mothers could have more parental leave recorded or could request annual leave following the convalescent or parental leave periods.

Figure 6 and 7 depict leave-taking habits for mothers in the 6-week maternity leave policy period; with Figure 6 showing the monthly averages inclusive of mothers who had no leave observations and Figure 7 showing monthly averages of mother with at least one leave observation. Subsequent figures are separated in the same manner to differentiate between "leave-takers" and "leave-eligible" mothers. Figures 6 and 7 also show monthly annual leave used in addition to parental leave in the year following a birth event. Of the two graphs, Figure 7 is more representative of the quantity of leave-used relative to the quantity of leave authorized during the 6-week maternity leave policy period.

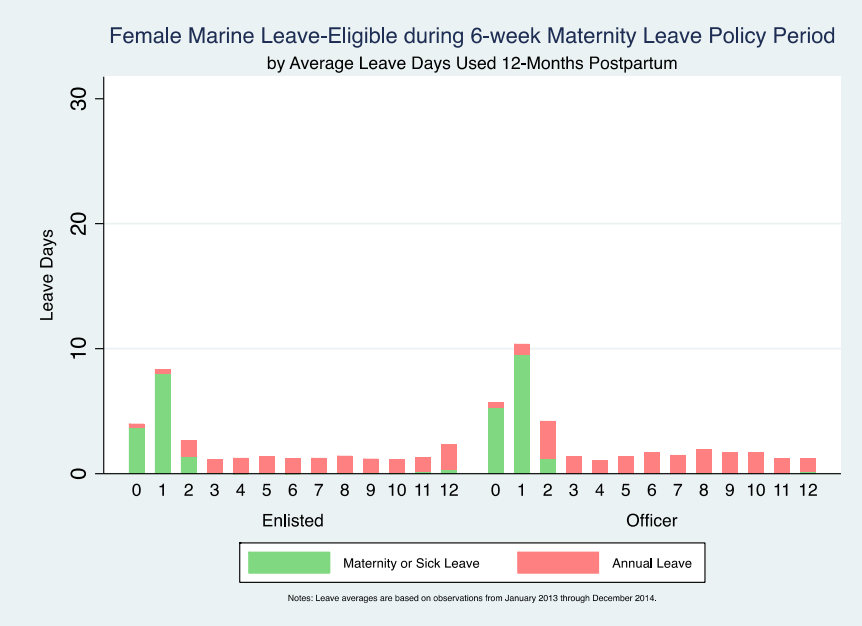

Figure 6. Leave Average for All Female Marines after Dependent Birth (6-Week Period)

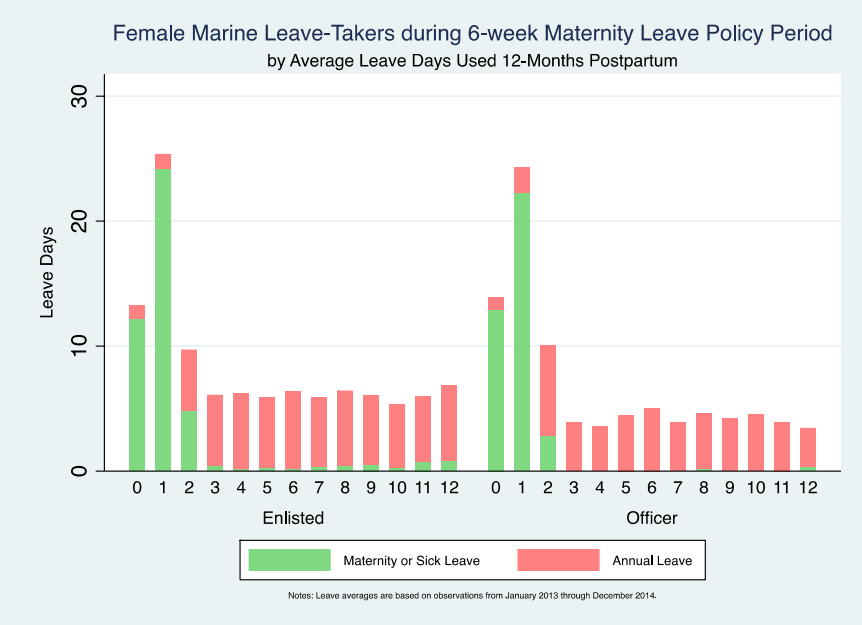

Figure 7. Leave Average for All Female Marines Who Took Maternity Leave after Dependent Birth (6-Week Period)

Figures 8 and 9 depict leave-taking trends for observations of mothers in the 18-week maternity leave policy period. Compared to the 6-week policy period, maternity and sick leave occurrences happened throughout the year following a birth event and as expected, since the 12 weeks of additional maternity leave could be taken non-consecutively within the year following a birth event. Similar to Figures 6 and 7, the differences in average leave days used between leave-takers and leave-eligible is substantial. Figure 9 more representative of the quantity of leave-used relative to the quantity of leave authorized during the 18-week maternity leave policy period. In both figures, enlisted and officer mothers used more parental leave in the first 4 months (months 0 to 3) following a birth event, rather than uniformly throughout the first year. For leave-takers in Figure 9, enlisted mothers averaged 102 days (14.5 weeks) of parental leave used in the first 4 months and officer mothers averaged 88 days (12.5 weeks) of parental leave used.

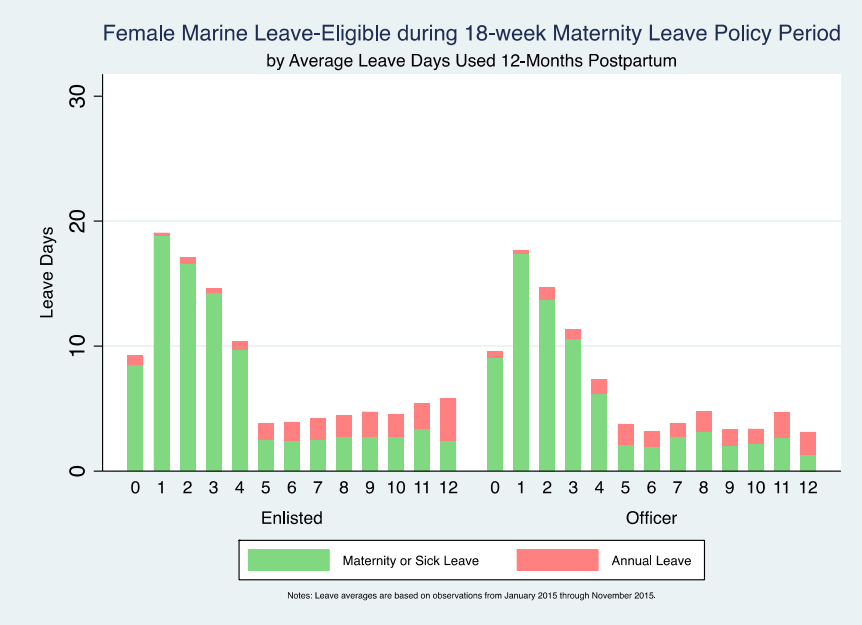

Figure 8. Leave Average for All Female Marines after Dependent Birth (18-Week Period)

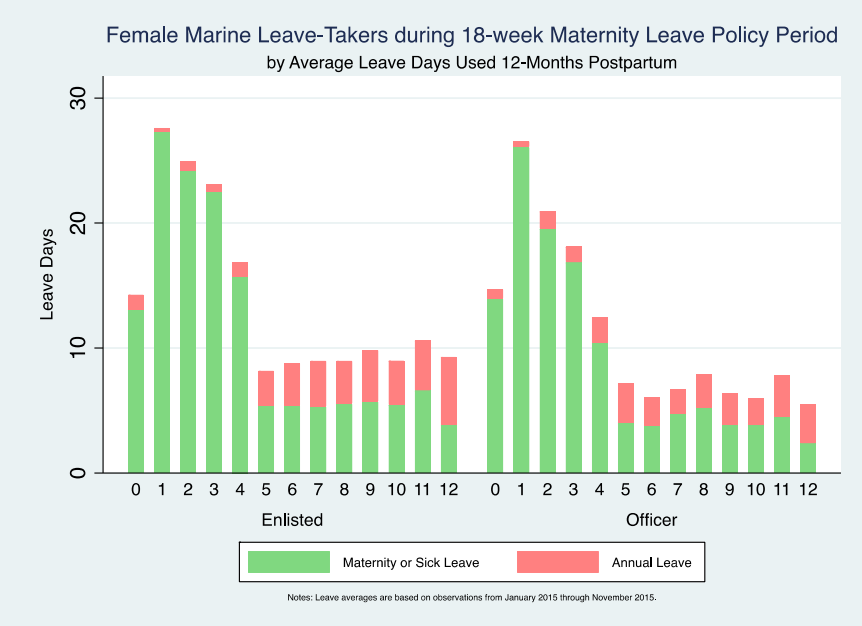

Figure 9. Leave Average for All Female Marines Who Took Maternity Leave after Dependent Birth (18-Week Period)

Figures 10 and 11 depict leave-taking trends for observations in the 12-week maternity leave policy period. As expected, most parental leave observations occur in the first 4 months (months 0 to 3) because of the change in requirement to take leave consecutively following a birth event. Relative to leave-takers in Figure 9 (18-week policy period), leave takers in Figure 11 (12-week policy period) used more leave during months 1 and 2, reflecting that change.

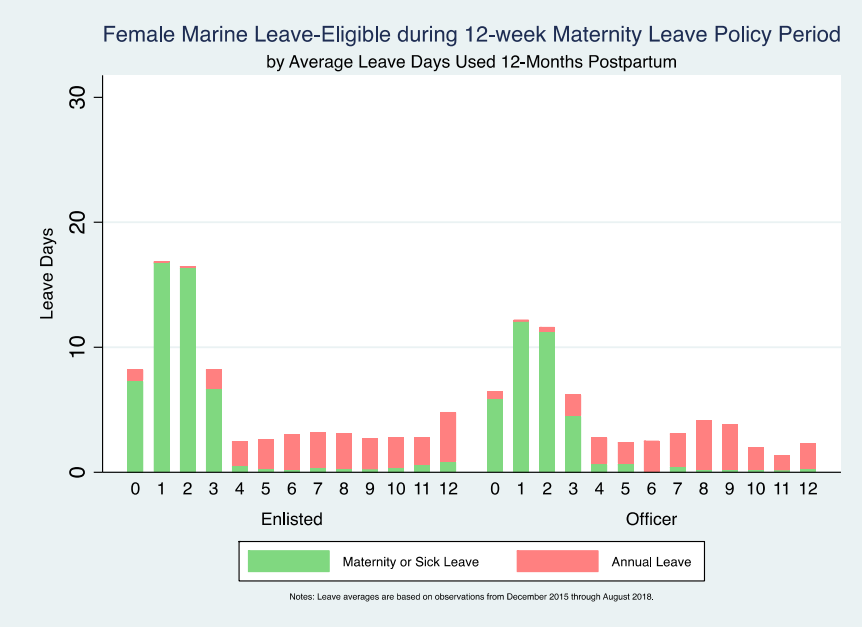

Figure 10. Leave Average for All Female Marines after Dependent Birth (12-Week Period)

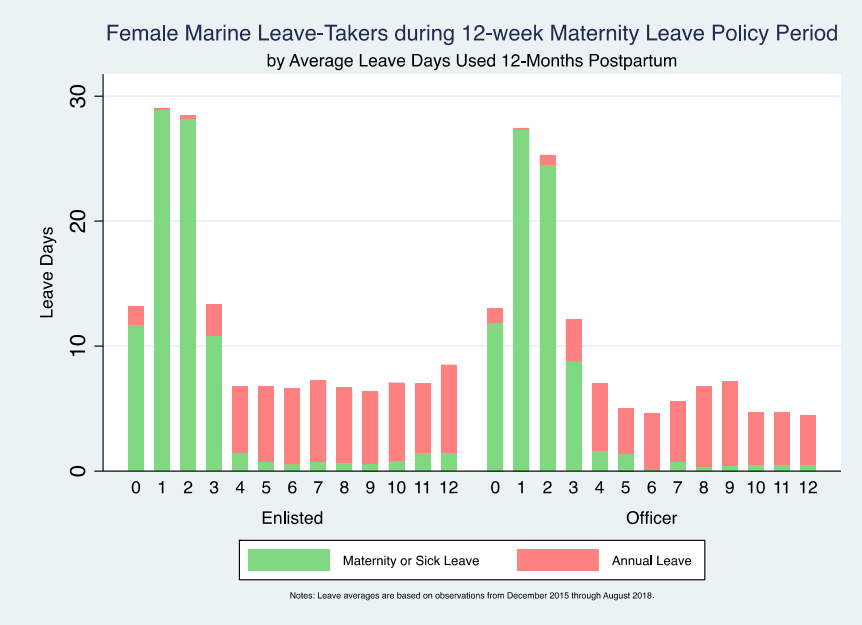

Figure 11. Leave Average for All Female Marines Who Took Maternity Leave after Dependent Birth (12-Week Period)

b. Paternity Leave Outcomes

Table 7 shows estimated leave-taking outcomes for fathers in a paternity status or the first 12 months after a dependent child's birth month. Similar to our maternity data, there are a large number of observations where no leave is observed in the year following a birth event. We attribute this pattern to the fact that fathers are still eligible to be deployed around the birth of a child, in contrast to mothers, and we did not have deployment status information. Also, there were only two observations of paternity leave taken during the 6-week policy period in our data. Those few instances may be the result of recording errors or it could actually be representative of paternity leave-taking behavior prior to the maternity leave policy changes. Observations of no-leave taking were included in leave regression estimates; however, we separate them in our graphical display of leave taking in order to distinguish between the behaviors of leave-takers and non-leave takers.

Table 7. First Difference: Leave-Taking Outcomes for Marine Fathers within 12 Months of Dependent Birth

	All Leave		All Parental Leave	
	(1) Percent	(2) Quantity	(3) Percent	(4) Quantity
12-week policy	0.057***	6.011***	0.026***	5.707***
	(0.002)	(0.428)	(0.001)	(0.114)
18-week policy	0.031***	6.089***	0.019***	3.635***
	(0.002)	(0.314)	(0.001)	(0.068)
Officer	0.018	3.668	0.015	-0.777
	(0.032)	(2.477)	(0.022)	(1.248)
Warrant Officer	0.002	3.379	-0.003	3.474
	(0.036)	(9.010)	(0.029)	(8.717)
African American	0.002*	-0.085	0.000	-0.098
	(0.001)	(0.249)	(0.001)	(0.081)
Other	0.001	0.457+	0.000	0.110
	(0.001)	(0.266)	(0.001)	(0.095)
Hispanic	0.004***	0.498*	0.002***	0.003
	(0.001)	(0.201)	(0.000)	(0.066)
Married	0.029***	-0.595*	0.025***	1.478***
	(0.001)	(0.291)	(0.001)	(0.100)
Military Spouse	-0.005***	0.989**	-0.001	0.157
	(0.001)	(0.359)	(0.001)	(0.132)
Constant	0.631***	140.078***	-0.058	-37.878***
	(0.155)	(8.779)	(0.095)	(5.842)
Observations	589007	49919	589007	49919
R^2	0.046	0.192	0.040	0.360

Standard errors in parentheses. Observations are limited to males in a paternity status, which is 12 months from baby date of birth. Comparison group is males in a paternity status during the 6-week policy period. Models (1) and (2) include all leave type observations, which are annual, combat, and permissive TAD. Maternity and sick leave are excluded. Models (3) and (4) include only parental leave type observations for males, which are permissive TAD. The models (1) and (3) outcome is binary and the models (2) and (4) outcome is quantity in days. Covariates include individual months, months to end of active service, months to end of active service quadratic, officers, warrant officers, age, race, ethnicity, occupational specialty, unit location, previous number of children, marital status, military spouse, education, and military classification test.
$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In our FD regression analysis of leave outcomes, we estimated positive and significant increases in the percent and quantity of leave taken for fathers following the maternity leave policy changes. The control group is fathers in a paternity status during the 6-week maternity leave policy period. Relative to fathers in the control group, fathers in the 12- and 18-week policy periods are 5.7-percentage points and 3.1-percentage points

more likely to take any leave (annual or PTAD) following a birth event, and 2.6-percentage points and 1.9-percentage points more likely to take parental leave (PTAD) following a birth event. Fathers in the 12- and 18-week policy periods take 6.0 and 6.1 more days of any leave following a birth event, and 5.7 and 3.6 more days of parental leave following a birth event, relative to fathers in the 6-week policy period. During the 12- and 18-week policy periods, fathers' quantity of all leave increased by a greater magnitude than fathers' quantity of parental leave used for the same period. This may represent fathers taking more annual leave to support their spouses after childbirth during these maternity periods. This is the opposite effect we saw in mothers during the 12- and 18-week policy periods who used less personal leave after they were granted additional weeks of maternity leave. This increase of more fathers using any leave may represent the secondary effects of the maternity leave increase for mothers.

Figures 12 through 17 display the quantities of leave taken by fathers each month in the year following a birth event. All figures separate quantities of leave taken for enlisted Marines and Marine officers, since we observed more leave taking by enlisted versus officers, overall. During all maternity leave policy periods, fathers were authorized 10 days of paternity leave, which was recorded as PTAD.

Figures 12 and 13 depict leave-taking habits for fathers in the 6-week maternity leave policy period, with Figure 12 showing monthly averages inclusive of fathers who had no leave observations and Figure 13 showing monthly averages of fathers with at least one leave observation. Subsequent figures are separated in the same manner to differentiate between "leave-takers" and "leave-eligible" fathers. Figures 12 and 13 also show monthly annual and combat leave used in addition to parental leave in the year following a birth event. Of the two graphs, Figure 13 is more representative of the quantity of leave-used by fathers who took leave, relative to the quantity of leave authorized during the 6-week maternity leave policy period. The average paternity leave quantities in Figures 12 and 13 are close to zero since only two observations of paternity leave occurred during the entire 6-week policy period.

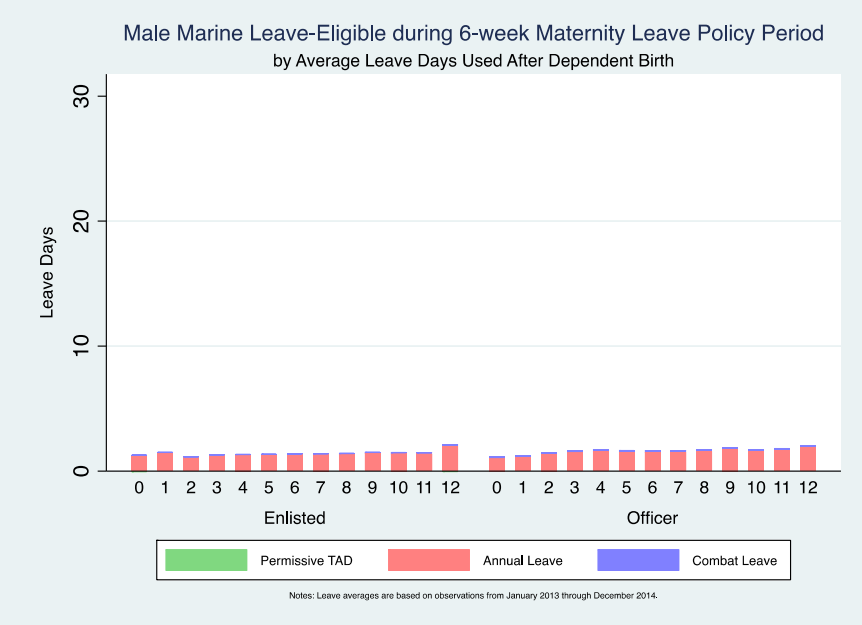

Figure 12. Leave Average for All Male Marines after Dependent Birth (6-Week Period)

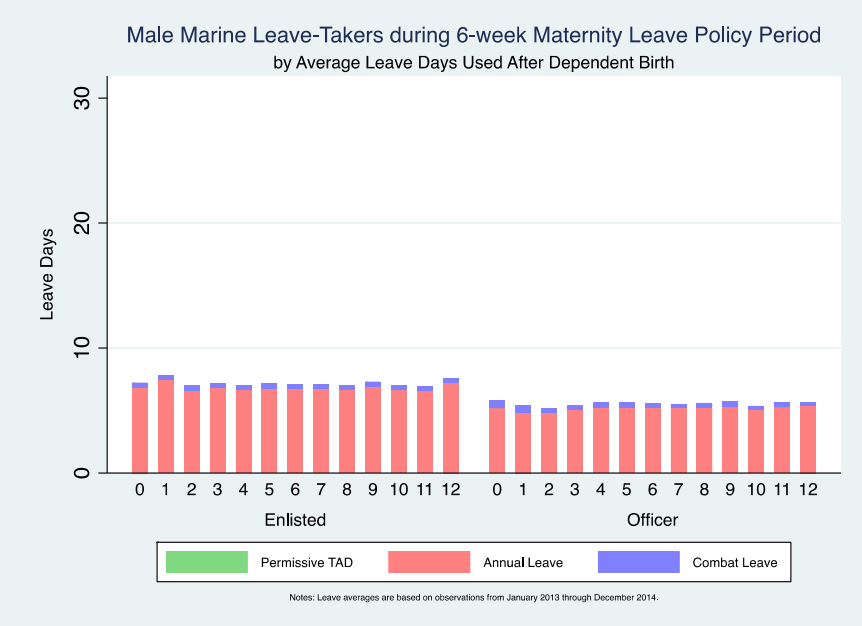

Figure 13. Leave Average for All Male Marines Who Took Paternity Leave after Dependent Birth (6-Week Period)

Figures 14 and 15 depict leave-taking trends for observations of fathers in the 18-week maternity leave policy period. Most occurrences of parental leave occurred directly following a birth event (months 0 to 1). For leave-takers in Figure 15, enlisted fathers averaged 9 days of parental leave used in the first month and officer fathers averaged 8 days of parental leave used.

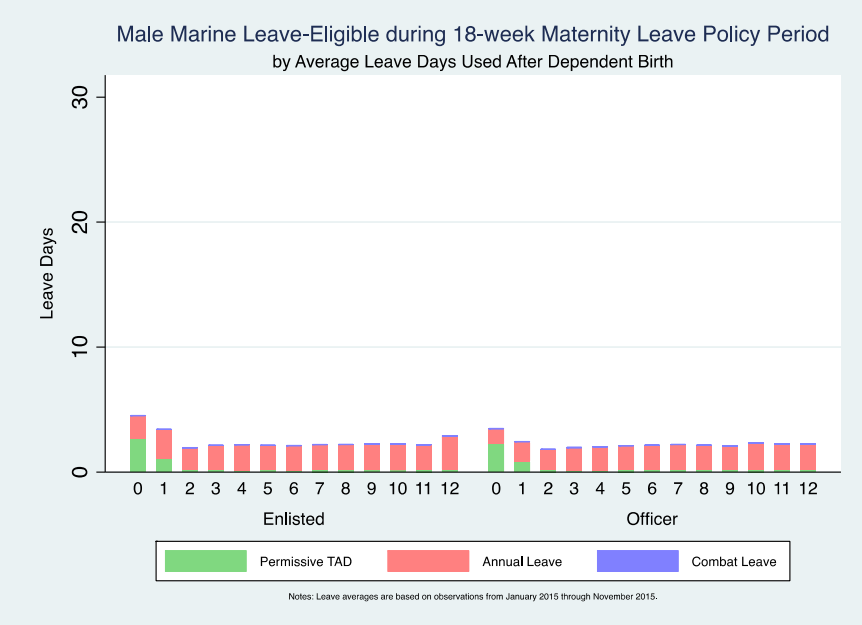

Figure 14. Leave Average for All Male Marines after Dependent Birth (18-Week Period)

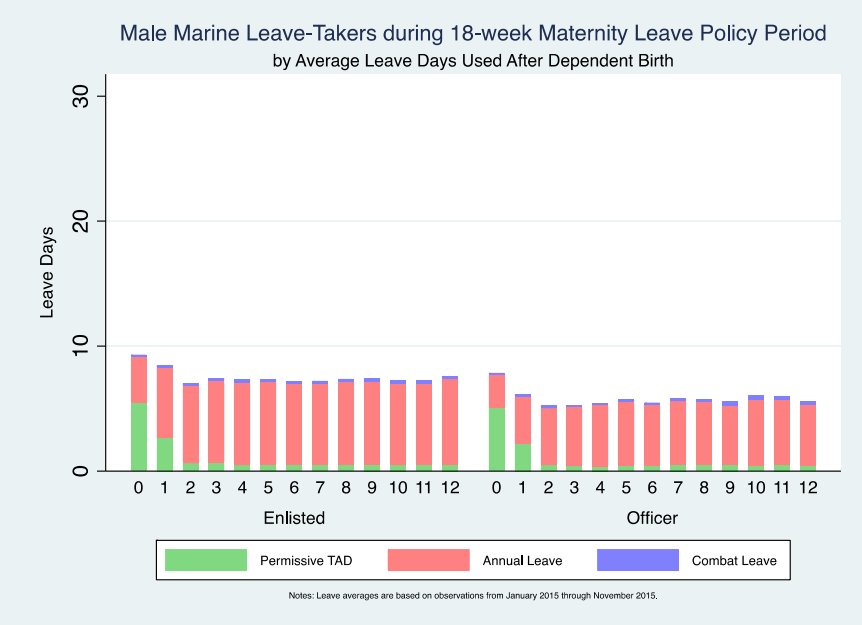

Figure 15. Leave Average for All Male Marines Who Took Paternity Leave after Dependent Birth (18-Week Period)

Figures 16 and 17 depict leave-taking trends for observations in the 12-week maternity leave policy period for fathers. For leave-takers in Figure 17, enlisted and officer fathers averaged 11 days of parental leave used in the first month, which increased in relation to the 18-week policy period.

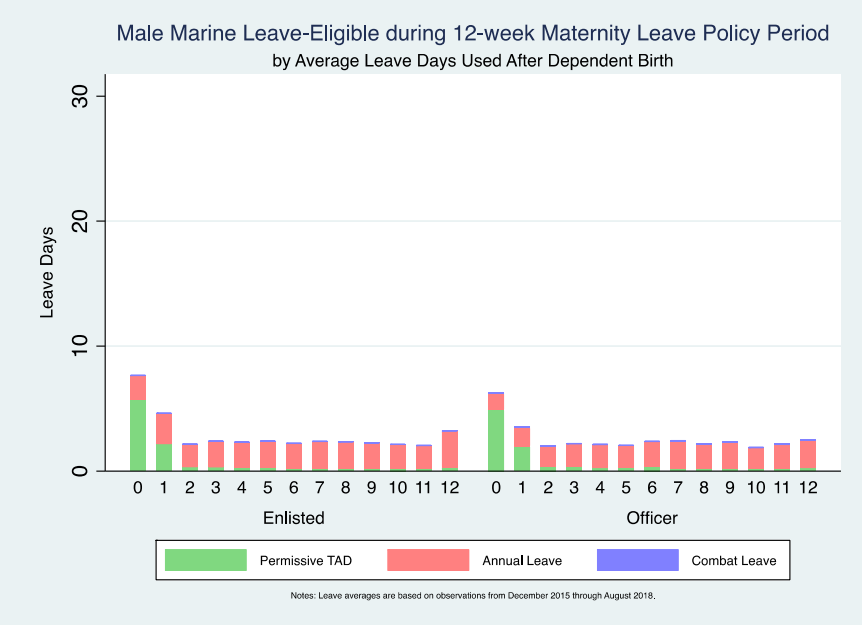

Figure 16. Leave Average for All Male Marines after Dependent Birth (12-Week Period)

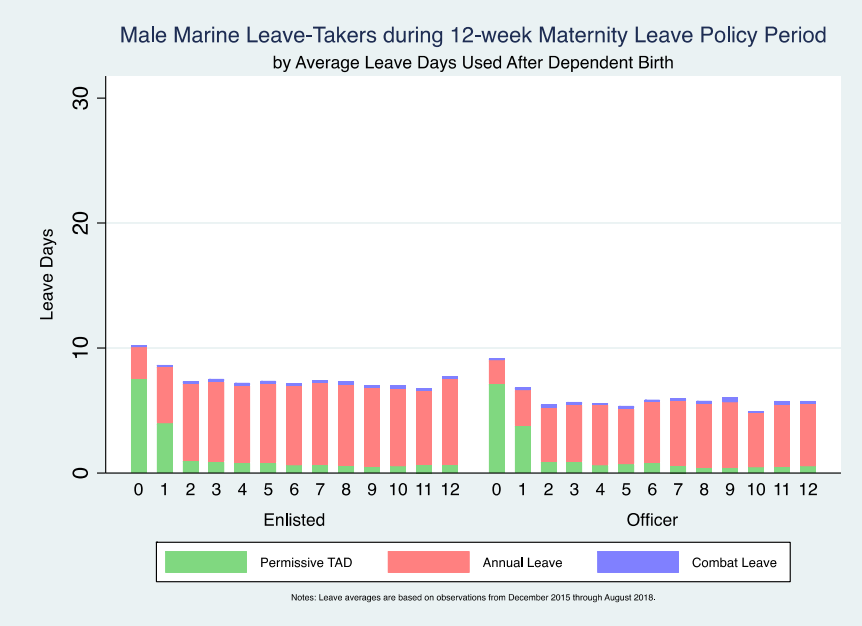

Figure 17. Leave Average for All Male Marines Who Took Paternity Leave after Dependent Birth (12-Week Period)

2. Retention Outcomes

In our RD models, adding covariates—particularly continuous variable controls that accounted for the DoD military drawdown and the federal unemployment rate—had various effects on the significance of our retention estimates and standard errors. In Table 8, Models (1) and (2) estimated retention of female Marines observed during the maternity leave policy increase from 6 to 18 weeks, relative to Marines exclusively in the 6-week policy period. There were no significant effects of the 18-week policy increase relative to the 6-week policy period for female retention estimates. Models (3) and (4) estimated retention of female Marines observed during the maternity leave policy reduction from 18 to 12 weeks, relative to Marines in the 6-week policy period. Model (3) estimates indicated an increased likelihood of leaving the service in the next 12 months; however, Model (4) estimates indicated a decreased likelihood of leaving the service in the next 12 months at a higher significance level, but with higher standard errors. Because there are fewer observations during the maternity leave policy decrease period, we are not confident that these estimates broadly represent female retention behaviors.

Table 8. Regression Discontinuity:12-Month Retention Outcomes for Female Marines

	(1) Policy Increase	(2) Policy increase/ Covariates	(3) Policy Decrease	(4) Policy Decrease/ Covariates
18-week policy	-0.065	-0.309		
	(0.068)	(0.227)		
12-week policy			0.141^{+}	-0.923*
			(0.082)	(0.383)
Monthly Drawdown		-4.777		6.565^{+}
		(4.805)		(3.438)
Monthly Unemployment Rate		-0.044		-0.636*
		(0.194)		(0.298)
Time (Months) Left to EAS		0.050***		0.046***
		(0.004)		(0.005)
Quadratic Time (Months) Left to EAS		0.001***		0.001***
		(0.000)		(0.000)
Observations	810	810	729	729
R^2	0.004	0.601	0.014	0.578

Standard errors in parentheses. All models are limited to females who had a baby during the observation period with a three- to twelve-year time in service constraint. Covariates include monthly drawdown, monthly unemployment rate, individual months, months to end of active service, months to end of active service quadratic, officers, warrant officers, occupational specialty, unit location, race, ethnicity, number of children, pay grade, marital status, military spouse, education levels, and military test scores. The twelve-month retention models (1) and (2) apply to the policy increase from six to eighteen weeks of maternity leave. The twelve-month retention models (3) and (4) apply to the policy reduction from eighteen to twelve weeks of maternity leave.
$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The RD graphs, Figures 18–21, show retention outcomes from 12-months leading up to the cut point to 7 to 9 months after. Figures 18 and 19 represent the 6- to 18- week maternity leave policy increase by gender, which occurred during January 2015. Figures 20 and 21 represent the 18- to 12- week maternity leave policy decrease by gender, which occurred during December 2016. Our cut points represent the retroactive start dates for the policy increase and decrease rather than the announcement dates.

Figure 19 estimated a 12-percentage point difference for female Marines at the cut point of the maternity leave policy increase from 6 to 18 weeks, and Figure 21 estimated a 7-percentage point difference at the cut point of the maternity leave policy decrease from 18 to 12 weeks. Both discontinuities indicated a decrease in service members leaving the

service in the next 12 months or an increase in retention of service members. There were minimal discontinuous effects across the cut point for males (Figures 18 and 20).

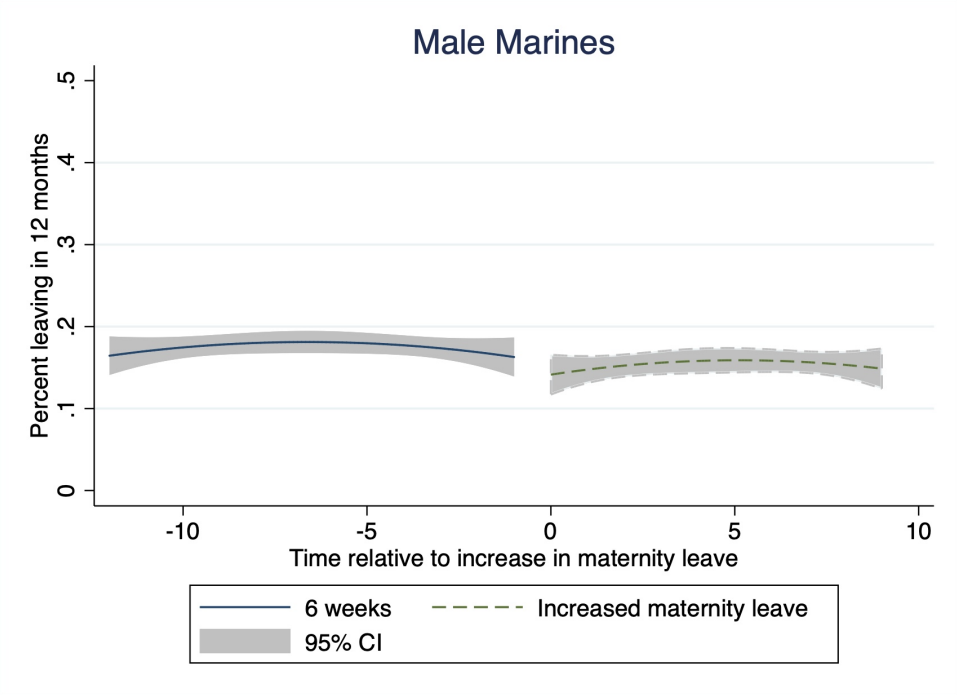

Figure 18. RD for USMC Males Relative to Maternity Policy Increase

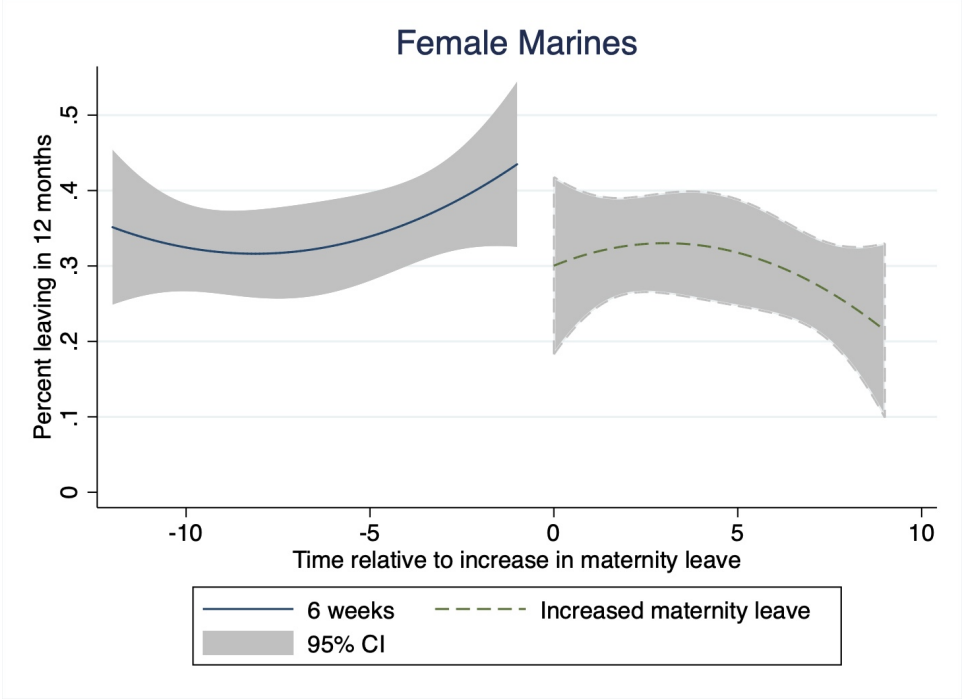

Figure 19. RD for USMC Females Relative to Maternity Policy Increase

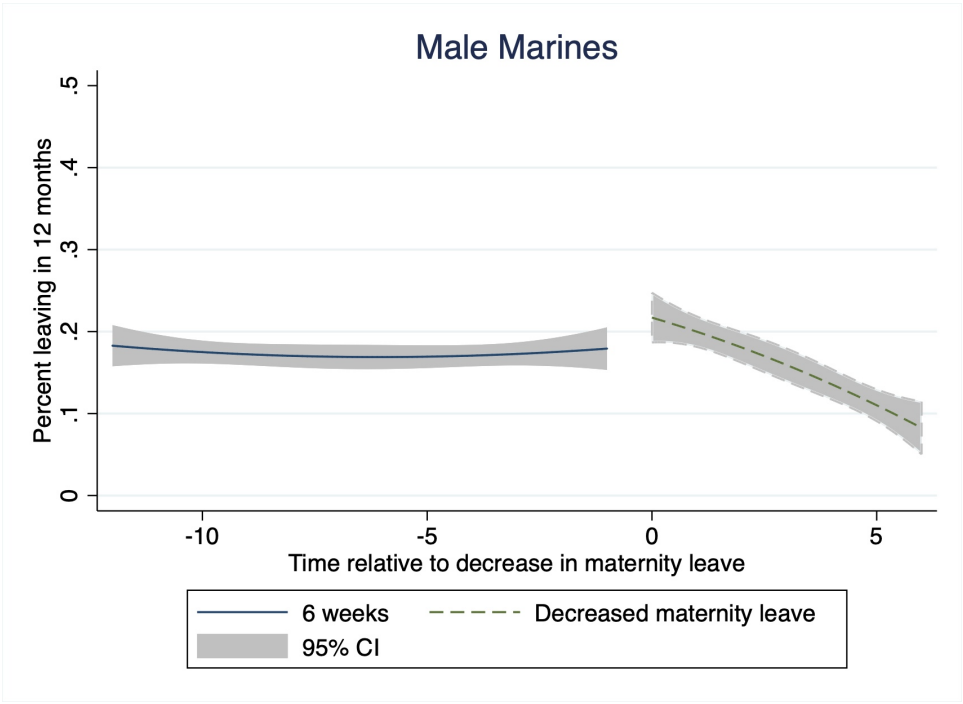

Figure 20. RD for USMC Males Relative to Maternity Policy Decrease

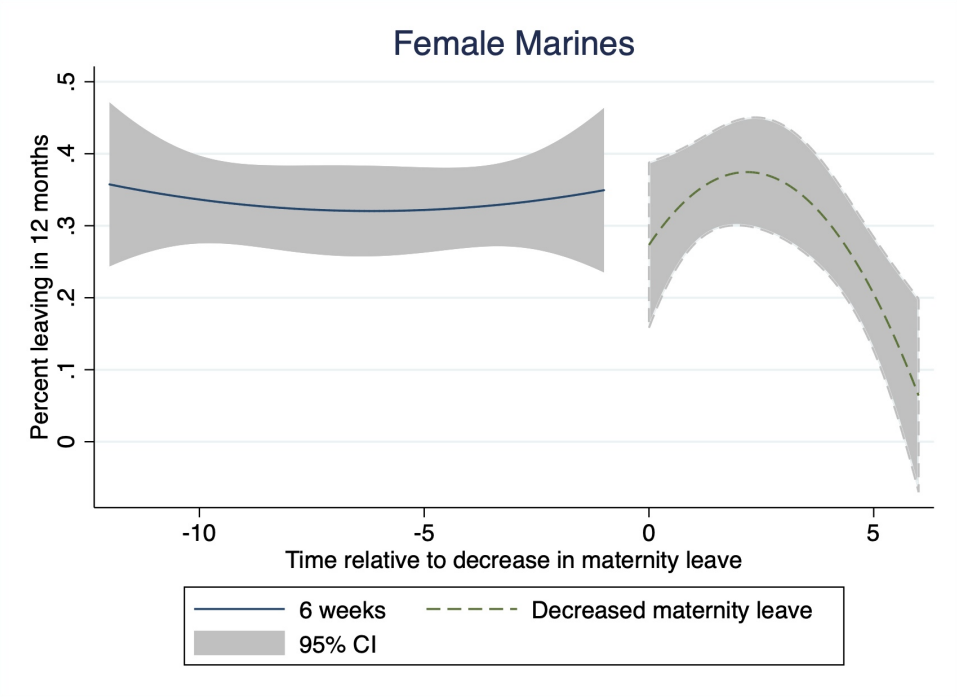

Figure 21. RD for USMC Females Relative to Maternity Policy Decrease

The difference in difference models (DiD) in Table 9, proved more informative when we examined policy effects for Marines with 3 to 12 years' time in service and younger than 50 years. In general, both female and male Marines who added a baby in any policy period are significantly less likely to leave the service within the next year, ranging from 4.6-percentage points to 9.2-percentage points respectively. Similar to the RD results, adding covariates either reduced the magnitude and/or statistical significance, and standard errors of retention estimates. Our preferred models, Models (2) and (4), contain covariates and best represent retention outcomes. Among the policy observation periods, there were no interactions between the policy periods and having a baby that reduced the likelihood of leaving in the next 12 months relative to having a baby during the 6-weeks maternity leave period. Because of the limited time period for observing the 6 to 18-week maternity leave increase, the estimated retention effects were not explanatory or significant. For female and male observations during the expected 12 weeks and received 12 weeks of maternity leave period, the estimated retention effects were statically significant across all models. We estimated female retention during this period increased by 13.8-percentage

points and male retention increased by 13.4-percentage points, relative to male and females observed during the expected 6 weeks and received 6 weeks of maternity leave period. However, when we interacted having a baby during this same expectation/policy period, female retention estimates were insignificant and male retention estimates reversed in magnitude to a 12.3-percentage point increase in the likelihood of leaving the service in the next 12 months. Similar to retention estimates in the 12-week expectation/policy period, the 18-week expectation/policy period estimates were statistically significant across all models. We estimated female retention during this period increased by 3-percentage points and male retention increased by 0.7-percentage points, relative to male and females observed during the 6-weeks maternity expectation/policy period. However, when we interacted having a baby during this same expectation/policy period, female retention estimates were insignificant and male retention estimates reversed in magnitude to a 2.1-percentage point increase in the likelihood of leaving the service in the next 12 months. In general, interacting having a baby with the policy periods increased the likelihood of leaving the service for males, and produced mixed or statistically insignificant results for females.

Table 9. Difference in Difference:12-Month Retention Outcomes for Marines

	Female		Male	
	(1)	(2)	(3)	(4)
	3-12yrs	Covariates 3-12yrs TIS	3-12yrs	Covariates 3-12yrs TIS
Baby Appeared	-0.054***	-0.046***	-0.247***	-0.092***
	(0.016)	(0.012)	(0.003)	(0.003)
Expect 6 weeks Maternity Leave, Get 18 weeks	-0.043***	-0.038***	-0.011***	-0.031***
	(0.007)	(0.006)	(0.002)	(0.002)
Baby + Expect 6 weeks Maternity Leave, Get 18 weeks	0.025	0.021	-0.003	0.014*
	(0.036)	(0.025)	(0.008)	(0.006)
Expect 12 weeks Maternity Leave, Get 12 weeks	-0.197***	-0.138***	-0.188***	-0.134***
	(0.007)	(0.010)	(0.002)	(0.003)
Baby + Expect 12 weeks Maternity Leave, Get 12 weeks	0.046*	0.017	0.121***	0.123***
	(0.023)	(0.019)	(0.005)	(0.005)
Expect 18 weeks Maternity Leave, Get 18 weeks	-0.064***	-0.030***	-0.013***	-0.007**
	(0.007)	(0.008)	(0.002)	(0.002)
Baby + Expect 18 weeks Maternity Leave, Get 18 weeks	0.054*	0.008	0.018**	0.021***
	(0.024)	(0.018)	(0.005)	(0.005)
Drawdown		-0.823***		-1.443***
		(0.179)		(0.054)
Unemployment Rate		0.020***		0.040***
		(0.005)		(0.001)
Time (Months) Left to EAS		0.043***		0.041***
		(0.001)		(0.002)
Quadratic Time (Months) Left to EAS		0.001***		0.000***
		(0.000)		(0.000)
Observations	259895	259895	3147583	3147583
R^2	0.027	0.476	0.026	0.493

Standard errors in parentheses. Reference group for models one and two are female Marines who expect six weeks of maternity leave and fall under the six-week maternity leave policy during the observation period. Reference group for models three and four are male Marines who fall under the six-week maternity leave policy during the observation period. Models one and three have no covariates. Models two and four contain covariates. Covariates include monthly drawdown, monthly unemployment rate, individual months, months to end of active service, months to end of active service quadratic, officers, warrant officers, occupational specialty, unit location, race, ethnicity, number of children, pay grade, marital status, military spouse, education levels, and military test scores.

$^{+}p < 0.1$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

3. Birth Outcomes

The FD models in Table 10 depict the estimates of having a baby during a specific expectation/policy period. The control group is birth outcomes observed during the 6-week expectation/policy period. Our estimates indicated no significant effects of any expectation/policy period on birth outcomes. The expect 12 and get 12 weeks of maternity leave period was omitted due to lack of observations. Figure 22 shows mean birth outcomes for officers and enlisted through December 2017. Averages are relatively consistent through 2015, and show a small decline beginning in 2016.

Table 10. First Difference: Birth Outcomes for Female Marines

	All Female		All Female Limited	
	(1) 3-12yrs	(2) Covariates/ 3-12yrs TIS	(3) 3-12yrs	(4) Covariates/ 3-12yrs TIS
Expect 6 weeks Maternity Leave, Get 18 weeks	-0.001 (0.000)	-0.001 (0.001)	-0.001 (0.001)	-0.002 (0.001)
Expect 18 weeks Maternity Leave, Get 18 weeks	-0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.001)
Drawdown		-0.043** (0.016)		-0.097*** (0.022)
Unemployment Rate		0.001** (0.000)		0.001 (0.001)
Time (Months) Left to EAS		-0.000** (0.000)		-0.000*** (0.000)
Quadratic Time (Months) Left to EAS		-0.000*** (0.000)		-0.000*** (0.000)
Observations	399728	399728	279024	279024
R^2	0.000	0.003	0.000	0.013

Standard errors in parentheses. Reference group for models one and two are female Marines who fall under the six-week maternity leave policy (and not the retroactive eighteen-week policy) during the observation period. Reference group for models three and four are female Marines who fall under the six-week maternity leave policy during the observation period and have no births during the observation period or previous children. Models one and three have no covariates. Models two and four contain covariates. Covariates include monthly drawdown, monthly unemployment rate, individual months, months to end of active service, months to end of active service quadratic, officers, warrant officers, occupational specialty, unit location, race, ethnicity, number of children, pay grade, marital status, education levels, and military test scores.
$^{+}p < 0.1$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

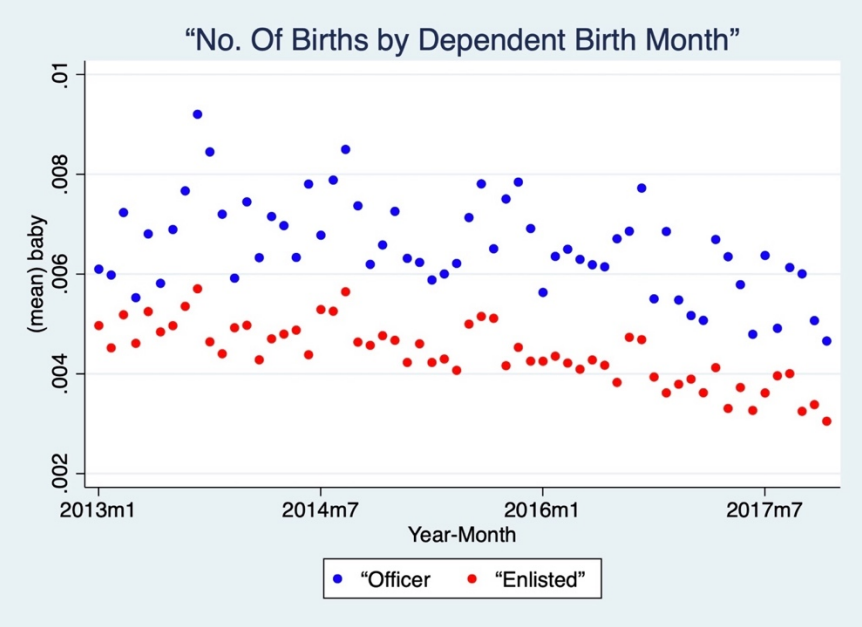

Figure 22. Average Number of Babies Born to Mothers by Dependent Birth Month

4. Pregnancy Outcomes

The FD models in Table 11 depict the estimates of becoming pregnant during a specific expectation/policy period. The control group is pregnancy outcomes observed during the 6-week expectation/policy period. Our estimates indicated no significant effects on pregnancy outcomes during the expect 6 weeks and get 18 weeks of maternity leave outcomes. During the expect 18 weeks and get 18 weeks of maternity leave period, Models (2) and (4) indicated a 0.1-percentage point and 0.2-percentage point increase in becoming pregnant. The expect 12 and get 12 weeks of maternity leave period was omitted due to lack of observations. Figure 23 shows mean pregnancy outcomes for officers and enlisted through December 2017. Averages are relatively consistent through 2016, and show a small decline beginning in 2017.

Table 11. First Difference: Pregnancy Outcomes for Female Marines

	All Female		All Female Limited	
	(1) 3-12yrs	(2) Covariates/ 3–12yrs TIS	(3) 3-12yrs	(4) Covariates/ 3-12yrs TIS
Expect 6 weeks Maternity Leave, Get 18 weeks	-0.000	0.000	0.000	0.000
	(0.000)	(0.001)	(0.001)	(0.001)
Expect 18 weeks Maternity Leave, Get 18 weeks	-0.000	0.001*	0.000	0.002**
	(0.000)	(0.001)	(0.000)	(0.001)
Drawdown		-0.059***		-0.097***
		(0.013)		(0.017)
Unemployment Rate		0.002***		0.003***
		(0.000)		(0.000)
Time (Months) Left to EAS		-0.000***		-0.000***
		(0.000)		(0.000)
Quadratic Time (Months) Left to EAS		-0.000***		-0.000***
		(0.000)		(0.000)
Observations	399728	399728	286098	303434
R^2	0.001	0.004	0.001	0.012

Standard errors in parentheses. Reference group for models one and two are female Marines who fall under the six-week maternity leave policy during the observation period. Reference group for models three and four are female Marines who fall under the six-week maternity leave policy during the observation period and have no pregnancies during the observation period. Models one and three have no covariates. Models two and four contain covariates. Covariates include monthly drawdown, monthly unemployment rate, individual months, months to end of active service, months to end of active service quadratic, officers, warrant officers, occupational specialty, unit location, race, ethnicity, number of children, pay grade, military spouse, education levels, and military test scores.

$^{+}p < 0.1$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

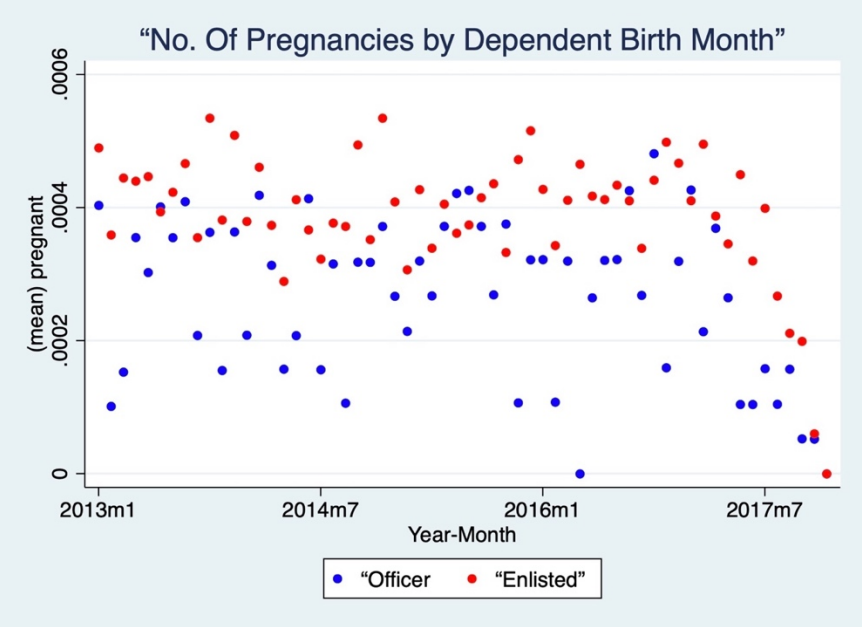

Figure 23. Average Number of Pregnancies of Mothers by Dependent Birth Month

B. DMDC RESULTS

The all-service data provided extensive observations that covered 4 branches of services; however, it did not contain certain variables that might add some explanatory power to our analysis (e.g., service member observations without dependents, deployment information, leave information, dependent DOB, and end of active service dates). Also, in order to increase the number of observations for the Navy and Marine Corps reduction from 18- to 12-weeks of maternity leave, another year (2018) of observation would be beneficial. Similarly, the 6- to 12-week maternity leave increase for the Army and Air Force would also benefit from an additional year of observation. Data observations include only service members with at least one or more of any type of dependent. Therefore, in our results discussion for the all-service data, our initial comparison group is always service members with at least one or more of any type of dependent.

In nearly all of our regression discontinuity models, adding covariates—particularly continuous variables that accounted for the DoD's drawdown and the federal unemployment rate—reduced or eliminated any previous significance. In Table 12, Models

(1) and (2) represent retention estimates among service members during the 12 months following a maternity leave policy change. We estimated that Marines within the maternity leave policy increase period from 6 to 18 weeks, relative to Marines exclusively in the 6-week policy period, experienced a 3.6-percentage point increase in the likelihood of leaving the service within 12 months. However, when we included covariates in Model (2), the estimated retention effects reduced in magnitude and became statistically insignificant. There were no overall effects of the 18-week policy increase relative to the 6-week policy period for the Navy and Marine Corps. In Model (1), service members in the 12-week policy period, relative to the 6-week period, experienced a 4.8-percentage point decrease in the likelihood of leaving the service within 12 months. When accounting for covariates in Model (2), the estimated retention effects reduced in magnitude and became statistically insignificant. By service, 12-month retention estimates were statistically significant only for the Air Force and Marine Corps, relative to the Army. We estimated that service members in the Air Force were 8.9-percentage points less likely to leave the service in the next 12 months, and service members in the Marine Corps were 14.1-percentage points more likely to leave the service in the next 12 months. Models (3) and (4) estimate 6-month retention effects; however, we believe the 12-month estimates are more reflective of service members decisions related to retention. Also, service and policy period effects that are significant during the 6-month retention period are not significant during the 12-month retention period.

Table 12. Regression Discontinuity: 12-Month and 6-Month Retention Outcomes for All Branches

	12-month Retention		6-month Retention	
	(1)	(2) Covariates	(3)	(4) Covariates
18-week policy	0.016	-0.038		
	(0.028)	(0.042)		
18-week policy=1 X Marine Corps X Time relative to increase in maternity leave	0.036***	-0.001		
	(0.009)	(0.012)		
18-week policy=1 X Navy X Time relative to increase in maternity leave	-0.006	0.006		
	(0.006)	(0.008)		
12-week policy	-0.048*	-0.012	-0.006	-0.077
	(0.019)	(0.035)	(0.025)	(0.136)
12-week policy=1 X Marine Corps X Time relative to decrease in maternity leave			-0.013+	-0.026*
			(0.007)	(0.012)
12-week policy=1 X Navy X Time relative to decrease in maternity leave			-0.022***	0.000
			(0.006)	(.)
Drawdown		-0.340*		-0.341+
		(0.167)		(0.206)
Unemployment Rate		0.052		0.137
		(0.050)		(0.104)
Air Force		-0.089**		
		(0.033)		
Marine Corps		0.141*		
		(0.066)		
Navy		-0.015		-0.022
		(0.057)		(0.068)
Military Spouse		-0.007		-0.040**
		(0.009)		(0.014)
Constant	0.225***	1.265***	0.146***	0.188
	(0.009)	(0.352)	(0.014)	(0.744)
Observations	10980	10980	3781	3781
R^2	0.027	0.158	0.018	0.160

Standard errors in parentheses. All models are limited to females who had a baby during the observation period with a three- to twelve-year time in service constraint. Covariates include monthly drawdown, monthly unemployment rates, individual months, individual branch, officers, warrant officers, race, ethnicity, number of children, pay grade, marital status, military spouse, occupation, unit location and education levels. The 12-month retention models (1) and (2) apply to all the Army Air Force, Navy and Marine Corps. The six-month retention models (3) and (4) apply to the policy reduction from eighteen to twelve weeks of maternity leave for the Navy and Marine Corps only.

$^{+}p < 0.1$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

The RD graphs, Figures 24–27, show retention outcomes from 12 months leading up to the cut point to 9 months after. The discontinuity points for Figures 24 and 25 are an average of the policy increase for all services by gender. Figure 26 represents the 6- to 12-week maternity leave policy increase for the Army and Air Force, which occurred during December 2015. Figure 27 represents the 6- to 18- week maternity leave policy increases for the Navy and Marine Corps, which occurred during January 2015. Our cut points represent the retroactive start dates for both policy increases rather than the announcement dates.

Figure 24 estimated a 3-percentage point difference for females in all branches and Figure 27 estimated a 7-percentage point difference at the cut point of maternity leave policy change for females in the Navy and Marine Corps. There were minimal discontinuous effects across the cut point for males in all services and females in the Army and Air Force (Figures 25 and 26).

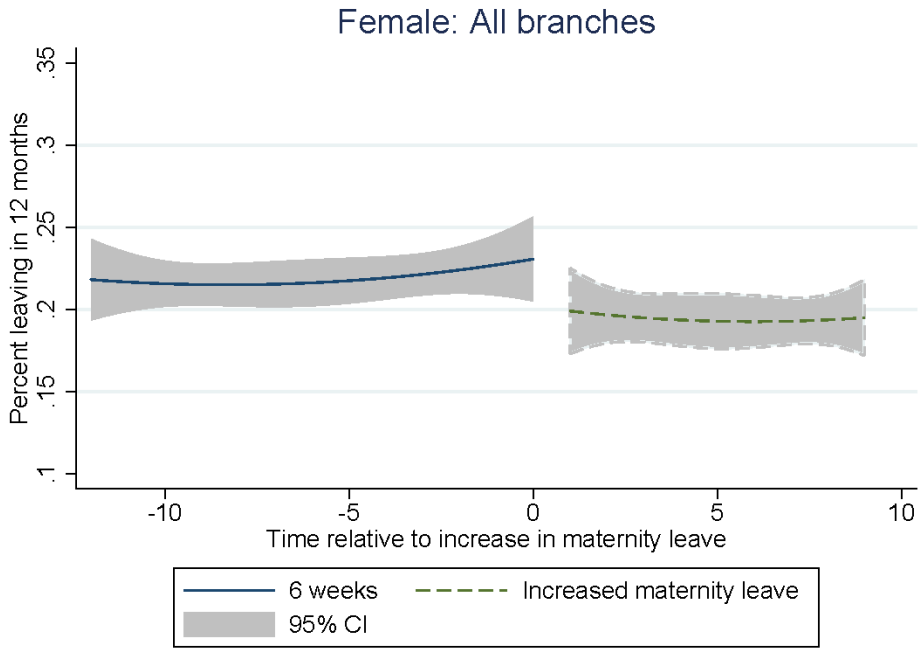

Figure 24. RD of All Female Service Members Retention

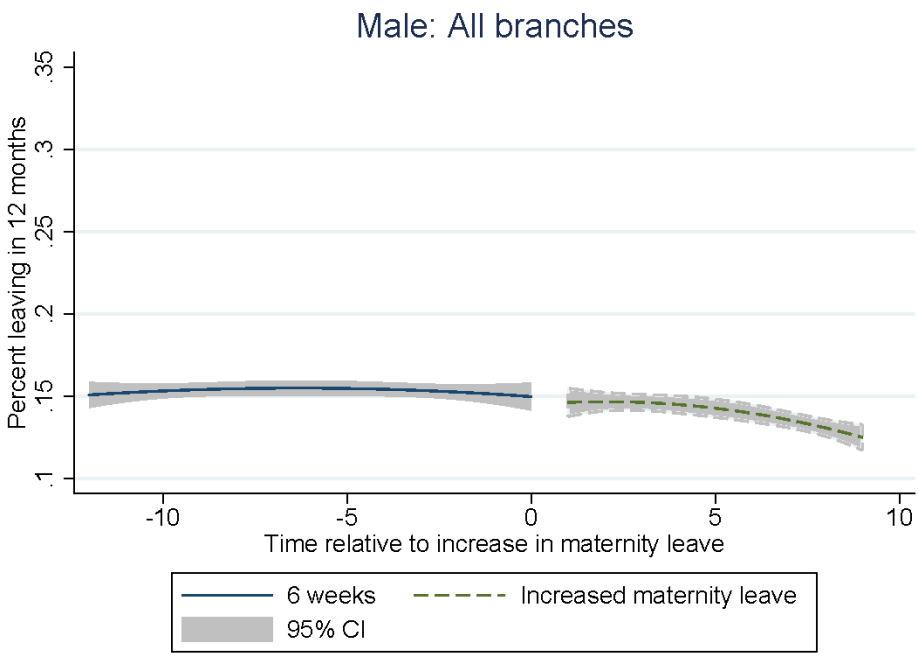

Figure 25. RD of All Male Service Members Retention

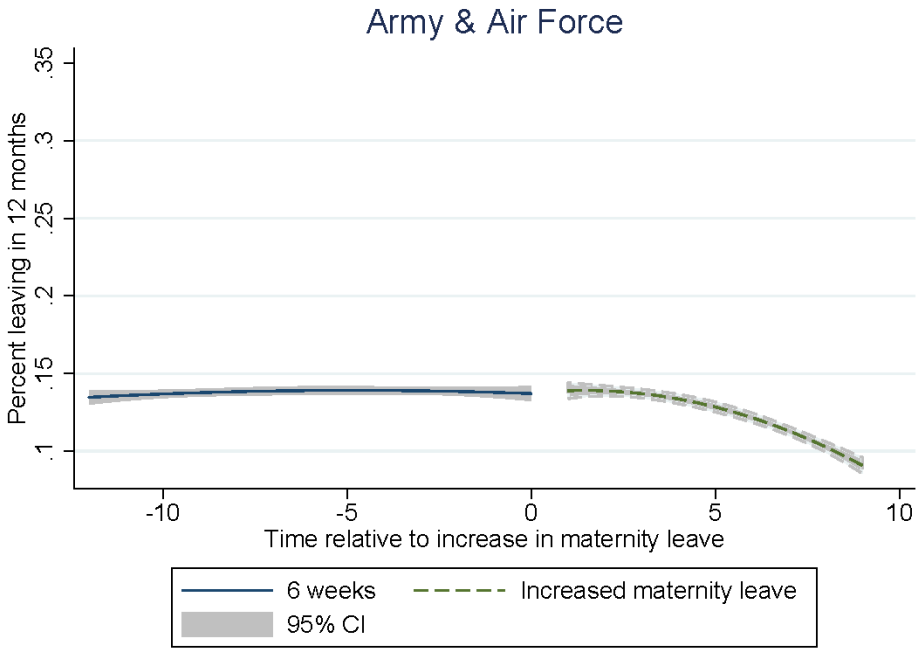

Figure 26. RD of All Female USA and USAF

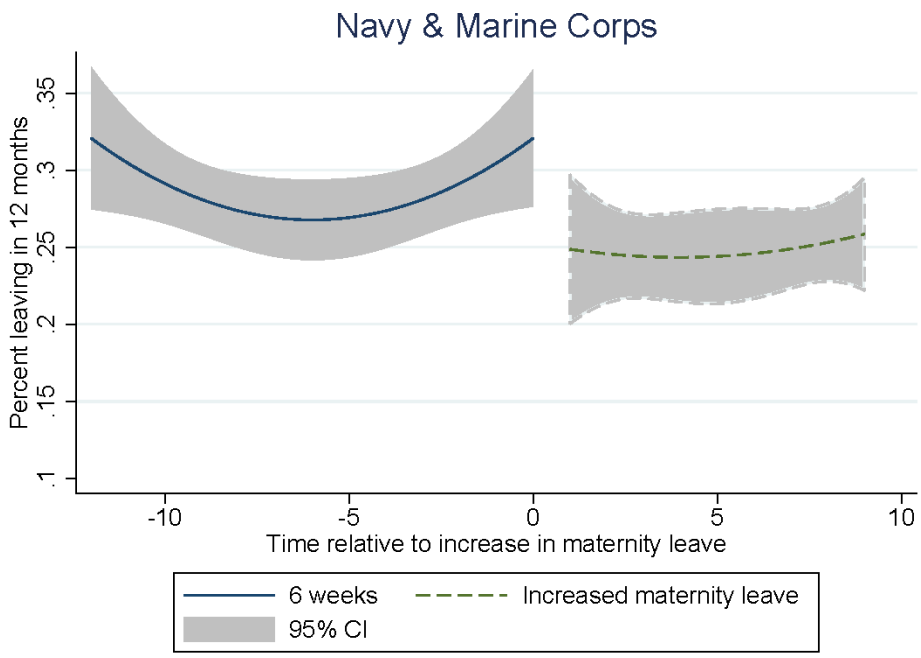

Figure 27. RD of All Female USN and USMC

The difference in difference models (DiD) in Table 13, proved more informative when we examined policy effects across services and over time, for service members with 3 to 12 years' time in service, younger than 50 years, and with at least one dependent. In general, both female and male service members who added a baby in any policy period are significantly less likely to leave the service within the next year, ranging from 5.9-percentage points to 8.2-percentage points respectively. Similar to the RD results, adding covariates either reduced the magnitude and/or statistical significance, and standard errors of retention estimates. Our preferred models, Models (2) and (4), contain covariates and best represent retention outcomes. Among the policy observation periods, only women who had a baby and expected 6 weeks, but received 12 weeks of leave, reduced their likelihood of leaving in the next 12 months by 5 percentage points, relative to women who had a baby in the 6-week policy period and received only 6 weeks of maternity leave. Because of the limited time period for observing the expect 6 weeks of maternity leave and get 18-week of maternity leave for the Navy and Marine Corps, the estimated retention effects were not explanatory or significant as a result of the retroactive maternity leave policy period. For

female and male observations during the expected 12 weeks and received 12 weeks of maternity leave period, the estimated retention effects were statically significant across all models. We estimated female retention during this period increased by 9.3-percentage points and male retention increased by 8.5-percentage points, relative to male and females observed during the expected 6 weeks and received 6 weeks of maternity leave period. However, when we interacted having a baby during this same expectation/policy period, female retention estimates were insignificant and male retention estimates reversed in magnitude to a 3.4-percentage point increase in the likelihood of leaving the service in the next 12 months. Similar to retention estimates in the 12-week expectation/policy period, the 18-week expectation/policy period estimates were statically significant across all models. We estimated female retention during this period increased by 2.7-percentage points and male retention increased by 2.6-percentage points, relative to male and females observed during the expected 6 weeks and received 6 weeks of maternity leave period. However, when we interacted having a baby during this same expectation/policy period, female and male retention estimates reversed in magnitude to a 1.7-percent point (female) and 2.4-percentage point (male) increase in the likelihood of leaving the service in the next 12 months. By service, 12-month female and male retention estimates were statistically significant for the Air Force, Navy and Marine Corps, relative to the Army. The Air Force and Navy estimates indicated a decrease in the likelihood of leaving the service in the next 12 months relative to the Army; and the Marine Corps estimates indicated an increase in the likelihood of leaving the service in the next 12 months relative to the Army.

Similar to the TFDW results, interacting having a baby with the policy periods increased the likelihood of leaving the service for males, and produced mixed or statistically insignificant results for females. We believe the changes in magnitude and direction of our estimates across genders and when interacting baby with the expectation/policy periods are indications of external factors not controlled for in our models. We discuss these potential factors in our conclusions.

Table 13. Difference in Difference: 12-Month Retention Outcome, All Services, TIS Limitation

	Female		Male	
	(1)	(2)	(3)	(4)
	3-12yrs TIS	Covariates 3-12yrs TIS	3-12yrs TIS	Covariates 3-12yrs TIS
Baby Appeared	0.007^{+}	-0.059***	-0.048***	-0.082***
	(0.004)	(0.005)	(0.001)	(0.001)
Expect 6 weeks Maternity Leave, Get 12 weeks	-0.012**	0.006	-0.015***	-0.001
	(0.004)	(0.004)	(0.002)	(0.002)
Baby X Expect 6 weeks Maternity Leave, Get 12 weeks	-0.060***	-0.050***	0.005	0.012*
	(0.014)	(0.014)	(0.005)	(0.005)
Expect 6 weeks Maternity Leave, Get 18 weeks	-0.010^{+}	-0.009^{+}	-0.012***	0.001
	(0.005)	(0.005)	(0.002)	(0.002)
Baby X Expect 6 weeks Maternity Leave, Get 18 weeks	0.036*	0.001	0.016***	0.008^{+}
	(0.014)	(0.013)	(0.005)	(0.004)
Expect 12 weeks Maternity Leave, Get 12 weeks	-0.100***	-0.093***	-0.092***	-0.085***
	(0.003)	(0.004)	(0.001)	(0.002)
Baby X Expect 12 weeks Maternity Leave, Get 12 weeks	-0.014*	-0.008	0.023***	0.034***
	(0.006)	(0.006)	(0.002)	(0.002)
Expect 18 weeks Maternity Leave, Get 18 weeks	-0.016***	-0.027***	-0.031***	-0.026***
	(0.005)	(0.005)	(0.002)	(0.002)
Baby X Expect 18 weeks Maternity Leave, Get 18 weeks	0.044***	0.017*	0.025***	0.024***
	(0.009)	(0.009)	(0.003)	(0.003)
Drawdown		-0.033		0.123***
		(0.027)		(0.010)
Unemployment Rate		0.007***		-0.002**
		(0.002)		(0.001)
Air Force		-0.037***		-0.069***
		(0.007)		(0.003)
Marine Corps		0.097***		0.041***
		(0.012)		(0.004)
Navy		-0.046***		-0.077***
		(0.008)		(0.003)
Military Spouse		0.010**		0.008**
		(0.003)		(0.002)
Constant	0.213***	0.175**	0.199***	1.140***
	(0.002)	(0.054)	(0.001)	(0.015)
Observations	1049126	1049126	6145163	6145163
R^2	0.010	0.118	0.009	0.129

Standard errors in parentheses. Reference group is service members who fall under the six-week maternity leave policy during the observation period. Models two and six have no covariates. Models four and eight contain covariates. Covariates are monthly drawdown, monthly unemployment rates, individual months, individual branch, officers, warrant officers, race, ethnicity, number of children, pay grade, marital status, military spouse, occupation, unit location and education levels.

$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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V. CONCLUSION

A. CONCLUSION

Following the maternity leave policy changes, leave taking for mothers and fathers increased in quantity and shifted in composition during the year after a dependent childbirth. After the 18-week maternity policy announcement, fathers were 5 percent more likely to use any leave in the paternity period, while mothers were 3.3 percent and 3.4 percent more likely to use parental leave and any leave, respectively. Males were also 6.4 percent and 4.1 percent more likely to be on parental leave and any leave following the 12-week maternity policy announcement. The sharp discontinuity at both maternity leave policy announcement periods demonstrated that any increases in parental leave for mothers and fathers were a reaction to the new policies and not an indication of gradual increases in leave taking over time. The amounts of parental leave used by mothers and fathers also increased in both the 12- and 18-week maternity leave policy periods relative to the 6-week maternity leave policy period. For fathers, these changes occurred without a subsequent increase in paternity leave policy during the period of observation. We use caution when interpreting the parental leave results due to the potential that better maternity and paternity leave-recording coincided with the maternity leave policy changes. However, annual and combat leave appear to be consistently recorded, so even if the change in paternity leave taken was a result of more paternity leave recorded, there was still an uptick in leave taking for fathers.

The increases in leave-taking may also indicate that maternity leave policy implementations led to a shift in workplace attitudes towards parental leave for mothers *and fathers*, within the Marine Corps. Although paternity leave amounts had not yet changed during our data observation period, the Marine Corps' culture surrounding leave-taking may have improved for fathers.

The composition of leave-taking also changed for mothers and fathers. The increased quantities of parental leave used by new mothers exceeded the increased amounts of all leave used by new mothers during the 18-week policy period. This outcome suggests

that mothers used parental leave in the 18-week policy period in place of annual leave used by mothers in the 6-week maternity leave policy period. More specifically, the additional maternity leave allowed mothers to reduce annual leave used previously to supplement time they wanted or needed following childbirth. During the 12- and 18-week policy periods, fathers increased their quantities of all leave used more than parental leave used for the same period. This is not surprising since paternity leave allowed (10 days) remained constant. However, fathers took more annual leave following the maternity leave policy changes, potentially to supplement the lack of additional paternity leave.

We claim no causal effects of the changes in maternity leave policies for service members on birth outcomes, pregnancy, or retention during the data observation period. The limited Marine observations for birth and pregnancy outcomes indicated no significant effects as a result of the policy changes. Across all services, retention outcomes relating to maternity leave policy changes and having children were not consistent. Also, when accounting for the military drawdown leading up to the U.S. presidential election and the changes in the national unemployment rate across our years of observation, the magnitude and statistical significance of retention outcomes were diminished.

B. FURTHER RESEARCH

Our research could be expanded to include leave-taking and deployment data for all services, if available, and additional observations (2018) for the 12-week maternity leave policy. In particular, dependent DOB would add further value and precision to the all-service analysis. Because most services recently expanded their paternity leave and/or shifted their parental leave policies to a more gender-neutral platform, a study on the effects of those policy changes could provide more insight on father leave-taking behaviors, and specifically, the caregiver behaviors of dual service parents.

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